March 2009

Regulatory Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions Proposed Rule (GHG Reporting)

Cost Appendix

CONTENTS

1. SUBPART E—ADIPIC ACID PRODUCTION

Model Facility Development

For the Adipic Acid Production subpart, one model facility was developed based on the 4 separate adipic acid production facilities and assuming that each facility has one process stack. All testing required for Option 3 and Option 4 was assumed to be done on each process stack.

The selected option, Option 3 uses periodic direct monitoring of N_2O emissions from each process stack to develop a site-specific emissions factor based on adipic acid production levels.

Option 4 uses CEMS to directly measure N_2O concentration and flow rate to directly determine N_2O emissions; these costs were calculated using the CEMS Cost Model, assuming that an N_2O analyzer is similar in cost to a CO_2 analyzer and that the facility does not have existing CEMS equipment. The facility-level inventory does not indicate that any adipic acid production facilities have existing CEMS.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3
    i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours.
    ii. Monitoring costs (for sampling and analysis) were estimated for conducting the annual stack test. On average, it would take 18.5 hours for an industrial engineer/technician and 18.5 hours for an industrial manager to conduct each stack test for a total of 37 hours per facility. The O&M costs total $2,400 for equipment, $1,234 for travel, and $117 for testing for a total of approximately $3,750 per facility.
    iii. Reporting costs were estimated on an annual basis, assuming 24 hours for an industrial engineer/technician, 4.4 hours for an industrial manager, and 8.8 hours for administrative staff to prepare the annual report for a total of 37.2 hours. Recordkeeping and QA/QC costs were estimated assuming 8 hours a piece for an industrial engineer/technician, 0.4 hours a piece for an industrial manager, and 0.8 hours a piece for administrative staff to prepare the annual report for a total of 18.4 hours.
b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 4
    i. Initial planning costs were estimated for the time needed to review the rule, prepare required initial notifications and records, resolve questions, reviewing

drawings, conduct source inspections, and define constraints was 39 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings and annual review total 27 engineer/technical hours in the first year and 46 hours in subsequent years. Operation and maintenance costs were estimated assuming $364 for resolving questions and inspecting the source; $650 for selecting the equipment; $17,600 for support needed to prepare for installation of the CEMS equipment, including platforms, ladders, utilities, etc.; $66,663 for purchasing the CEMS equipment, $7,940 to install and check the CEMS equipment; and $75 for performance specification testing for a total of $93,292, annualized to $10,244.

ii. Monitoring costs (for sampling and analysis), including selecting equipment, installing/checking the CEMS, and the performance specification test accounts for 246 engineer/technical hours in the first year and 174 hours in the subsequent years.

iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 24 engineer/technical hours in the first year and 4 hours in subsequent years.

Assigning Costs to Cost Elements

Option 3

Table 1-1.

Subpart E—Adipic Acid Production	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,544.22	$463.86
QA/QC					0.4	0.4							8	8	0.8	0.8	$493.73	$493.73
Recordkeeping					0.4	0.4							8	8	0.8	0.8	$493.73	$493.73
Sampling, Analysis and Calculations					18.5	18.5							18.5	18.5			$2,335.26	$2,335.26
Reporting					4.4	4.4							24	24	8.8	8.8	$1,898.25	$1,898.25
Total	0	0	0	0	31.7	25.7	1	1	0	0	0	0	74.5	62.5	18.4	10.4	$6,773.41	$5,684.83

Table 1-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$2,400	$2,400	$2,400
Performance testing				$117	$117	$117
Recordkeeping					$0	$0
Travel				$1,234	$1,234	$1,234
Total	$0		$0	$3,751	$3,751	$3,751

Option 4

Table 1-3.

Subpart E—Adipic Acid Production Option 4	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													39				$ 2,153	$0
QA/QC													27	46			$ 1,500	$2,539
Recordkeeping														18			$0	$994
Sampling, Analysis and Calculations													246	174			$13,586	$9,604
Reporting													24	4			$1,325	$221
Total	0	0	0	0			0	0	0	0	0	0	336	242	0	0	$18,564	$13,357

Table 1-4.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$93,217	$93,217	$1,000
Performance testing				$75	$75	$2,499
Recordkeeping				$0	$0	$50
Travel				$0	$0	$0
Total			$0	$93,942	$93,942	$3,549

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

2. SUBPART F—PRIMARY ALUMINUM PRODUCTION

Table 2-1. Number of Representative Affected Entities Used in the Cost Analysis.

Threshold	Number of Representative Entities
1,000	14
10,000	14
25,000	14
100,000	14

Options Analyzed

Costs were estimated for two options (*Option 2* and *Option 3* from the Technical Support Document[1]) for estimating PFC emissions from primary aluminum production and for one option (*Option 2* from the Technical Support Document) for estimating CO_2 process emissions from primary aluminum production.

►*PFC Emissions*

To estimate PFC emissions, *Option 2* requires smelter-specific data on aluminum production and anode effect minutes per cell day, as well a technology-specific slope factor for CWPB smelter technology. *Option 3* requires smelter-specific data on aluminum production, anode effect minutes per cell day, and recently measured smelter-specific slope coefficients. *Option 2* differs from *Option 3* only in that the technology-specific slope coefficient is replaced with a smelter-specific slope coefficient (IPCC 2006).

Under *Option 3*, a model facility measures its smelter-specific slope-coefficients once every three years, incurring labor costs. In addition to labor costs, facilities without in-house equipment to measure slope coefficients will need to hire a consultant and rent measurement equipment. These facilities will have additional non-labor costs for equipment rental, and travel, food, and lodging for the contracted consultant.

[1] Technical Support Document for Process Emissions from Primary Aluminum Production, EPA-HQ-OAR-2008-0508-006.

►CO2 Emissions

For CO_2, *Option 2* is used to estimate emissions based on metal production and net anode consumption, using default values for the non-carbon components of the anodes (e.g., sulfur and ash).

STEP 1: Model Facility Development

Aluminum production capacities at U.S. primary production facilities are generally comparable (low hundreds of thousand metric tons). Costs were therefore developed for a single model facility based on reported average labor burdens and annualized average non-labor costs.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into four elements, each of which was taken into consideration for this sector:

1. Regulation compliance determination costs
2. Monitoring costs
3. Reporting costs
4. Recordkeeping costs

Labor hour burdens for managerial, technical, and clerical staff associated with reporting emissions estimation data (e.g., reviewing regulations, gathering the requested monitoring data, and completing, signing and submitting a report) were developed from the 2005 renewal for the Information Collection Request by EPA for EPA's Voluntary Aluminum Industrial Partnership (EPA 2005). Although Partner companies do use smelter-specific slope coefficients to estimate emissions, the labor burdens for measuring smelter-specific slope coefficients is not included in the reported ICR costs, and therefore, the ICR costs can be assumed to be equal to the costs for an *Option 2* PFC emission estimate.

Labor burdens and non-labor costs for measuring smelter-specific slope coefficients for conducting an *Option 3* PFC analysis were developed separately based on expert judgment.

All labor hours were multiplied by current labor costs to calculate the reporting costs under the proposed reporting rule.

1. Regulation Compliance Determination Costs

Regulation compliance determination costs were established from the ICR based on the labor burdens for reviewing the requirements and previous report(s). This activity applied to both managerial and technical staff.

2. Monitoring Costs

Anode effect frequency and duration are monitored and recorded using computer systems already in place at smelters. These systems are considered BAU, since they are instrumental to the proper functioning of the smelter. Thus, their capital costs are not included in the anticipated cost elements for tracking emissions of PFCs. Similarly, metal production and carbon anode consumption are routinely monitored and recorded using systems already in place at smelters, and their costs are not included in the costs for tracking emissions of CO_2.

Monitoring costs were drawn from the ICR based on the labor burdens for gathering the requested monitoring data and other information. This activity applied to both managerial and technical staff. Managerial staff check the monitoring and perform other managerial activities pertaining to the monitoring. The technical staff gather and compile metal production, carbon anode consumption, anode effect frequency, and anode effect duration data.

The labor costs for gathering the information required to estimate CO_2 process emissions (both during electrolysis and anode baking) were not included in the 2005 ICR, but were assumed to be the same as those for gathering production and anode effect frequency and duration data for estimating PFC emissions.

3. Reporting Costs

Reporting costs were established from the ICR based on the labor burdens for completing the report, and signing and submitting the report. This activity applied to both managerial and clerical staff. The managerial staff complete, review, and sign the reporting documentation. Clerical staff submit the report.

4. Recordkeeping Costs

These costs were not separately estimated for this source category. The method and assumptions used to estimate recordkeeping costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in Different Model Facility Levels

An analysis of what proportion of facilities fall into different model facility levels is not applicable to this sector, since the model facility was constructed as a single average facility that is applicable to all U.S. primary aluminum production facilities.

STEP 4: Assigning Costs to Cost Elements

The assignment of costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized average weighted non-labor costs per facility

These steps are described in further detail below.

►***Determine Labor Categories***

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, three labor categories were used as shown in Table 2-2.

Table 2-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, and performs measurements.	$55.20/hour
Clerical	Assists with documentation and recording information.	$29.65/hour

►***Allocate Responsibilities and Estimate Labor Hours***

Labor hours for all cost elements were assigned based on reported ICR labor burdens and expert judgment. Table 2-3 summarizes the allocation of hours and responsibilities by labor category.

Labor burdens for measuring smelter-specific slope coefficients for conducting an *Option 3* PFC analysis were developed based on expert judgment and apply a number of assumptions:

1. Facilities will measure their slope-coefficients once every 3 years, which will include total labor.
2. Labor costs to measure slope-coefficients are estimated to be between $33,000 and $35,000 (Marks 2008a). This analysis uses a cost of $35,000.
3. For the purposes of labor distribution, it is assumed that the technician (or contracted consultant) will spend nine times as many hours measuring the facility's slope coefficient than the manager will spend checking the measurement and performing other managerial activities pertaining to this measurement.

The annual labor burden for managerial staff for measuring smelter-specific slope coefficients under *Option 3* is estimated to be 20.5 hours for measuring smelter-specific slope coefficients. The additional annual labor burden for technical staff is estimated to be 185 hours for measuring smelter-specific slope coefficients.

Table 2-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category						
	Managerial		Technical		Clerical		Per Facility/ Per Company*
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Regulation compliance determination							
Regulation Review for fugitive PFC emissions	To review the requirements and previous report(s)	1.45	To review the requirements and previous report(s)	0.725			Per facility
Regulation Review for CO_2 process emissions	To review the requirements and previous report(s)	1.45	To review the requirements and previous report(s)	0.725			Per facility
Monitoring							
Monitoring of metal production, anode effect frequency, and anode effect duration data	To gather the requested data and other information	23.20	To gather the requested data and other information	43.50			Per facility
Monitoring of metal production, carbon anode consumption, initial weight of green anodes (GA),and baked anode (BA) production	To gather the requested data and other information	23.20	To gather the requested data and other information	43.50			Per facility
Measuring of smelter-specific slope coefficient[a]	To review the measurements	20.50	To measure the facility's slope coefficient	185.00			Per facility
Reporting							
Data Reporting Documentation for fugitive PFC emissions	To complete the reporting documentation	11.60					Per facility
Data Reporting Documentation for fugitive PFC emissions	To complete the reporting documentation	11.60					
Report Submission for CO_2 process emissions	To sign report	0.725			To submit report	0.725	
Report Submission for CO_2 process emissions	To sign report	0.725			To submit report	0.725	Per facility

[a] Calculated value (see below) rounded to the nearest quarter of an hour.

►***Other Costs***

Non-labor costs for measuring smelter-specific slope coefficients under *Option 3* were developed based on expert judgment and apply a number of assumptions:

1. Facilities will measure their slope-coefficients once every 3 years, which will include total labor.
2. Facilities without in-house equipment to measure slope coefficients will need to hire a consultant and rent measurement equipment. These facilities will have additional non-labor costs as follows:
    a. Equipment rental costs are estimated between $2,000 and $2,500 (Marks 2008a). This analysis uses a cost of $2,250.
    b. Travel, food, and lodging for the contracted consultant are an estimated $4,000 (Marks 2008a).
3. Of the 14 operational U.S. smelters, 10 have in-house equipment, and would not have any non-labor costs, whereas 4 would have non-labor costs of equipment rental and consultant costs of approximately $6,250 every 3 years.

The annual average of the non-labor costs presented above weighted across all 14 operational smelters is $595.24.

STEP 5: Estimation of Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The annual weighted average non-labor cost per facility was added to the labor costs per facility to estimate the total unit cost per entity. The unit cost per entity was multiplied by 16, i.e., the potential number of facilities that might exceed the reporting threshold, to determine the total national costs per year for this sector.

The unit cost per entity is the same at each reporting threshold, since all facilities exceed the reporting threshold at each level.

3. SUBPART I—ELECTRONICS PRODUCTION

STEP 1: Model Facility Development

This analysis is based on the costs of monitoring fluorinated greenhouse gas emissions from semiconductor manufacturing facilities. Semiconductor facilities constitute the vast majority of the electronics facilities likely to report under the rule, and EPA has acquired a detailed understanding of semiconductor facilities and their emissions through the PFC Reduction/Climate Partnership for Semiconductors, which has been in place since 1995.

In the proposed rule, semiconductor facilities with production capacities of 10,500 m^2 silicon or greater are considered "large" facilities and those with production capacities less than 10,500 m^2 silicon are considered "small" facilities. "Small" and "large" facilities are subject to different reporting requirements, as detailed below under "Monitoring Costs." These differences lead to different annual costs for "small" and "large" semiconductor facilities.

Other electronics manufacturing facilities (MEMs, flat panel display, photovoltaics) use fewer types of PFCs than the semiconductor manufacturing facilities. Therefore, cost estimates for these other types of electronics facilities were developed by scaling the costs for the small semiconductor facilities to account for the use of a smaller set of gases.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into four elements, which are described below.

1. Regulation compliance determination costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate compliance determination costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.
2. Monitoring costs. The following types of monitoring costs were identified:
    i. Collection of activity data for estimating PFC emissions. In the proposed rule, costs for collecting activity data differ depending on type of facility (large semiconductor, small semiconductor, MEMs, flat panel display, photovoltaics). In the proposed rule, semiconductor facilities with the largest potential to emit FCs would be required to use an approach for estimating emissions similar to the IPCC Tier 3 approach. The IPCC Tier 3 approach uses company-specific data on (1) gas consumption, (2) gas utilization, (3) by-product formation, and (4) destruction/removal efficiency (DRE) for all processes at the facility. Other facilities would estimate emissions using an approach similar to the IPCC Tier 2b approach. The Tier 2b approach uses company-specific data on gas consumption,

and a combination of IPCC Tier 2b default emission factors and company-specific data on gas utilization and by-product formation.

ii. Annual costs to validate the DREs of abatement devices every three years. Under the proposed rule, any facility that wished to reflect abatement of fluorinated GHGs in its emissions estimates would be required to obtain company-specific DRE measurements to quantify the gas destroyed. DRE validation costs were estimated assuming that only the 56 semiconductor facilities that participate in EPA's PFC Reduction/Climate Partnership for the Semiconductor Industry use abatement devices and would incur costs for verifying the DREs of these devices. Facilities that manufacture electronic devices other than semiconductors (PVs, MEMS, etc.) and semiconductor facilities that do not participate in EPA's PFC Reduction Partnership (119 semiconductor facilities) are assumed to incur no costs to validate DREs. Each abatement device would be tested once every three years. Facilities using abatement devices are assumed, on average, to make three DRE measurements per year.

iii. Collection of data for estimating heat transfer fluid (HTF) emissions. In the proposed rule, semiconductor manufacturing facilities would be required to account for emissions from use of heat transfer fluids using a mass-balance approach. (Facilities manufacturing other electronic devices are assumed not to use heat transfer fluids.) The mass-balance approach uses company-specific data and accounts for differences among facilities' HTFs (which vary in their global warming potentials), leak rates, and service practices.

3. Reporting costs.

   i. Reporting PFC emission estimate. In the proposed rule, electronics manufacturing facilities would be required to complete and submit company-specific annual reports.

   ii. Reporting heat transfer fluid emissions estimate. In the proposed rule, semiconductor manufacturing facilities (facilities manufacturing other electronic devices are assumed not to use heat transfer fluids) would be required to complete and submit data-reporting forms.

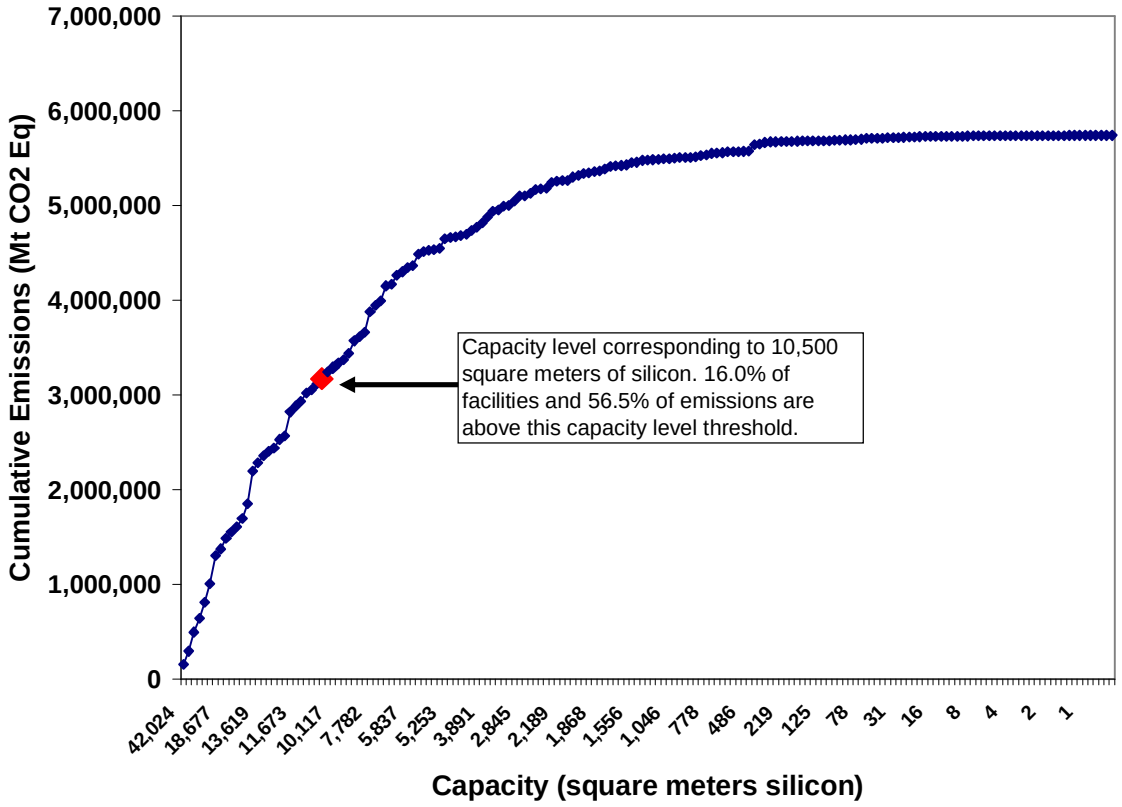
4. Recordkeeping costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate recordkeeping costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

An analysis was conducted to determine the capacity threshold level (e.g., square meters of silicon) above which facilities would be required to report using the Tier 3 approach (those categorized as "large" model facilities). Figure 3-1 is a plot of capacity thresholds (in square meters of silicon) versus the cumulative emissions (in $mtCO_2e$) covered at each threshold. The red point in Figure 3-1 marks a threshold of 10,500 square meters of silicon, and was chosen as a possible threshold for requiring Tier 3 reporting, since it would include between 10% to 20% of

facilities and greater than 50% of emissions. More specifically, a threshold of 10,500 square meters of silicon would identify 16% of all semiconductor manufacturing facilities as "large" facilities and require them to report using the Tier 3 approach (equivalent to 28 entities out of 175 total entities) and would include 56.5% of total semiconductor emissions (equivalent 3.2 Tg CO_2 Eq out of a total 5.7 Tg CO_2 Eq emissions). The remaining 147 facilities are considered "small" facilities and would be required to use the Tier 2b reporting approach.

Figure 3-1. Capacity Threshold Versus Cumulative Emissions Covered at Each Threshold



STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►***Determining Labor Categories***

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, four labor categories were used as shown in Table 3-1.

Table 3-1. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Legal	Oversees legal aspects of company reports and data-reporting forms.	$101.00/hour
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

►***Allocate Responsibilities and Estimate Labor Hours***

The burden hours and costs borne by small semiconductor facilities (with the exception of DRE validation costs) were estimated using the information presented in the Information Collection Request (ICR) for the PFC Reduction/Climate Partnership for Semiconductors, which is intended to capture the costs to Partners of reporting their annual emissions to EPA (EPA, 2000; EPA, 2008a). Most Partners currently use methods similar to the one proposed for small semiconductor facilities (i.e., the IPCC Tier 2b approach).

The burden hours and costs borne by large semiconductor facilities were estimated based on interviews with a major semiconductor manufacturer that uses the Tier 3 approach to estimate its emissions. The hours and costs for estimating emissions of heat transfer fluids were based on the ICR for EPA's SF_6 Emission Reduction Partnership for Electric Power Systems. Under the SF_6 Partnership, electric power systems report emissions using a mass-balance method that is essentially identical to that proposed for heat transfer fluids in semiconductor facilities. Finally, the costs of validating Destruction or Removal Efficiencies (DREs) were estimated based on EPA's experience in conducting multiple DRE measurements in semiconductor facilities.

Table 3-2 summarizes the allocation of hours and responsibilities by labor category.

Table 3-2. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities and Hours by Labor Category								
	Legal		Managerial		Technical		Clerical		Per Facility/ Per Company*
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Semiconductors: Large facilities									
Monitoring									
Collect activity data (gas consumption, gas utilization, by-product formation) for PFC emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	45	Collect data on gas consumption, gas utilization, and by-product formation. Ensure proper calibration and maintenance of flow meters.	280	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation	12	Per facility
Collect data for mass-balance calculation of Heat Transfer Fluids			Provide quality assurance of analyses and authorize completeness of the checks.	4	Collect activity data related to HTF emissions	17	Assist in recording and maintaining data on collected activity data related to HTF emissions	11	Per facility
Reporting									
Complete and submit company-specific annual report	Oversee legal aspects of annual report submission	0.3	Provide quality assurance of annual report.	10.8	Complete and submit company-specific annual report	25.3	Assist with completing and submitting the company-specific annual report	8.4	Per facility
Complete and submit data reporting forms for mass-balance calculation of Heat Transfer Fluids			Review and submit data reporting form.	3.5	Review instructions and complete the form for data reporting	3.5	Maintain data reporting records.	1.7	Per facility

(continued)

Table 3-2. Responsibilities for Regulation Compliance by Labor Category (continued)

Cost Element	Responsibilities and Hours by Labor Category								Per Facility/ Per Company*
	Legal		Managerial		Technical		Clerical		
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Small Facilities									
Monitoring									
Collect activity data (gas consumption, gas utilization, by-product formation) for PFC emission estimate			Provide quality assurance of analyses and authorize completeness of the checks.	7.2	Collect data on gas consumption. Perform calculations using a combination of IPCC Tier 2b default emission factors and company-specific data on gas utilization and by-product formation. Ensure proper calibration and maintenance of flow meters.	101.3			Per facility
Collect data for mass-balance calculation of Heat Transfer Fluids			Provide quality assurance of analyses and authorize completeness of the checks.	4	Collect activity data related to HTF emissions	17	Assist in recording and maintaining data on collected activity data related to HTF emissions	11	Per facility
Reporting									
Complete and submit company-specific annual report	Oversee legal aspects of annual report submission	0.3	Provide quality assurance of annual report.	10.8	Complete and submit company-specific annual report	25.3	Assist with completing and submitting the company-specific annual report	8.4	Per facility
Complete and submit data reporting forms for mass-balance calculation of Heat Transfer Fluids			Review and submit data reporting form.	3.5	Review instructions and complete the form for data reporting	3.5	Maintain data reporting records.	1.7	Per facility

(continued)

Table 3-2. Responsibilities for Regulation Compliance by Labor Category (continued)

Cost Element	Responsibilities and Hours by Labor Category								Per Facility/ Per Company*
	Legal		Managerial		Technical		Clerical		
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
MEMs									
Monitoring									
Collection of activity data			Provide quality assurance of analyses and authorize completeness of the checks.	2.2	Collect data on gas consumption, gas utilization, and by-product formation. Ensure proper calibration and maintenance of flow meters.	30.4	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation		Per facility
Reporting									
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.1	Provide quality assurance of annual report.	3.2	Complete and submit company-specific annual report	7.6	Assist with completing and submitting the company-specific annual report	2.5	Per facility
Flat Panel Displays									
Monitoring									
Collection of activity data			Provide quality assurance of analyses and authorize completeness of the checks.	3.6	Collect data on gas consumption, gas utilization, and by-product formation. Ensure proper calibration and maintenance of flow meters.	50.6	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation		Per facility
Reporting									
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.1	Provide quality assurance of annual report.	5.4	Complete and submit company-specific annual report	12.7	Assist with completing and submitting the company-specific annual report	4.2	Per facility

(continued)

Table 3-2. Responsibilities for Regulation Compliance by Labor Category (continued)

Cost Element	Responsibilities and Hours by Labor Category								Per Facility/ Per Company*
	Legal		Managerial		Technical		Clerical		
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Photovoltaics									
Monitoring									
Collection of activity data			Provide quality assurance of analyses and authorize completeness of the checks.	4.3	Collect data on gas consumption, gas utilization, and by-product formation. Ensure proper calibration and maintenance of flow meters.	60.8	Assist in recording and maintaining data collected on gas consumption, gas utilization and by-product formation		Per facility
Reporting									
Completion of company-specific annual report	Oversee legal aspects of annual report submission	0.2	Provide quality assurance of annual report.	6.5	Complete and submit company-specific annual report	15.2	Assist with completing and submitting the company-specific annual report	5.1	Per facility

►***Capital Cost Annualization and O&M Costs***

Because electronics manufacturing facilities are assumed to monitor gas consumption using equipment (e.g., flowmeters) that is already in place, capital costs were not factored into this cost analysis. There are no associated O&M costs.

►***Other Costs***

EPA estimates that the per-facility cost of validating DREs of abatement devices is $29,571 and $8,082 per year for a large and small semiconductor facility respectively. The cost estimate for a large semiconductor facility is an average across all large semiconductor facilities, including those that do not use abatement equipment, and is based on the proportion of large facilities that are participants in EPA's PFC Reduction/Climate Partnership for Semiconductors. The same method was used to estimate the cost for small semiconductor facilities. While 90% of this cost is related to labor and 10% is related to freight shipments and measurement study supplies, it is assumed that the facilities outsource the validation of DREs and thus this cost is not considered a labor cost for the facility. The average cost for a large facility is added on top of labor costs for large semiconductor facilities and the average cost for a small facility is added on top of labor costs for small semiconductor facilities.

STEP 5: Estimation of Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility for each type of facility (large semiconductor facilities, small semiconductor facilities, and MEMs, flat-panel display, and photovoltaic facilities). For semiconductor facilities, the industry average cost of validating DRE measurements was added to the labor costs per facility. Finally, the unit cost per facility was multiplied by the number of facilities that exceed the reporting threshold for each type of facility, resulting in the total national costs per year for this sector.

4. SUBPART J—ETHANOL WASTEWATER TREATMENT

STEP 1: Model Facility Development

For this source category, EPA evaluated ethanol refinery wastewater treatment plants to represent the types of wastewater treatment systems with the greatest potential to exceed the GHG threshold.

EPA first attempted to locate any plant-level datasets that would allow direct calculation of greenhouse gas emissions by plant. Where plant-level data were incomplete, EPA used default national-level data from the National Inventory to fill in missing data. Where plant-level data were unavailable, EPA instead determined the production levels for each industry that would trigger emissions over any of the thresholds of interest, and used best professional judgment to estimate how many plants would meet the production levels.

. . . For ethanol production, EPA used a readily available dataset from the Renewable Fuels Association (RFA 2006), prepared in support of the National Inventory, and containing production for all ethanol plants in operation as of July 2006. This dataset distinguished between dry and wet milling plants; however, it did not include plant-specific information on wastewater generation rates, influent BOD or COD levels, or treatment processes on site. Therefore, EPA used the default values from the National Inventory.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs.

1. Regulation study and review and registration costs are described in Section 4.2 of the RIA, and are not included in the costs reported in this appendix.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs. Capital investment will be required for purchasing monitoring equipment. This capital cost will be accounted as annualized cost on an annual basis. Labor will be required for product research for monitoring instruments before actual purchase. Before actual monitoring takes place, labor will have to be devoted to the development of a monitoring plan. EPA assumed that each plant would develop

its own monitoring plan, and that selected employees are already trained on how to use the monitoring equipment.

b. Recurring monitoring costs consist of labor required to conduct detection and measurement of emissions (i.e., perform actual monitoring of emissions). EPA assumed that each plant would conduct monitoring onsite.

3. Reporting costs

   a. There will be no start-up reporting costs; that is covered in registration.

   b. Recurring reporting costs consist of labor necessary to document collected emissions data from fugitive emissions monitoring and to submit the official report in each cycle (i.e., annually).

4. Archiving and recordkeeping costs and auditing costs are not discussed in detail in this appendix. Instead, please refer to section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

EPA estimated the number of ethanol plants using plant-specific datasets, as described in Step 1. . .

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►***Determining Labor Categories***

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, three labor categories were used as shown in Table 4-1.

Table 4-1. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Industrial Manager	Oversees Technician and Operator activities, including reviewing monitoring plan and emissions estimates.	$71.03/hour
Plant and System Operator	Develops monitoring plan and conducts monitoring of wastewater. Gathers plant data and estimates emissions.	$36.29/hour

Industrial Engineer/Technician	Conducts monitoring of emission sources (i.e., digester systems).	$55.20/hour

►***Allocating Responsibilities***

Assigning labor hours for all cost elements was based on expert judgment. Annual costs for wastewater sampling includes the labor to collect samples, calculate emissions, and report the results. EPA assumes that wastewater samples and emission calculations will be performed by a Plant and System Operator. These operators are already familiar with conducting wastewater testing, including BOD, suspended and dissolved solids, and dissolved oxygen, and record the results in standardized reports designed to meet Federal and State regulations.

EPA estimates that two hours of labor is needed per month to collect and organize flow data, for a total annual cost of $871. EPA estimates that one hour of labor is needed for each sampling episode. Each COD wastewater sample is estimated to have analytical costs of $30, based on an average of laboratory rate schedules. EPA assumed monthly sampling episodes, which results in an annual sampling cost of $795.

Facility staff will need to calculate and report emissions once per year, using flow and COD data gathered. EPA assumes this effort will require 8 hours for an operator, with one hour of supervisory review, with a total annual cost of $361.

The annual cost to operate the continuous measurement system includes the cost to calibrate the analyzers monthly and to compile annual emission reports. These tasks are assumed to require 14 hours a year of an industrial technician. The annual costs also include $200 for gas analyzer calibration kits. The total annual costs including labor and calibration kits are $973.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are due to the annualized capital costs.

►***Capital Cost Annualization and O&M Costs***

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection, emissions measurement, and information storage. All costs are reported in 2006 U.S. dollars and annualization was assumed over an equipment life of 20 years with a 7% interest rate. From these factors, a capital recovery factor of 9.4% was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 4-2 below summarizes the capital costs associated with the monitoring program.

Table 4-2. Monitoring Program Compliance Capital Costs and Other O&M

Element	Capital Cost	Annualized Capital Cost
Archiving		
Capital Costs	Cost of archiving material per facility assumes cost of 1 file cabinet, 4-drawer vertical from Office Depot™ ($140), and 1 hard drive for data storage from Seagate™ ($95)	$57
Monitoring		
Equipment Purchase	Continuous gas composition monitoring equipment for anaerobic digestion systems would require a continuous gas composition analyzer, a temperature sensor, a gas pressure sensor, and a data logger	$3,640

The two primary instruments used in the continuous measurement method are an in-line gas flow meter and an in-line gas composition meter. EPA assumes industrial wastewater treatment plants that are using digesters already have an in-line gas flow meter. The instruments available for continuously measuring the methane content of biogas include the Guardian Plus by Topac and the GA-2000 by Geotechnical Instruments.

The temperature and pressure of the gas flowing through the instruments must also be measured. These two parameters are generally measured with a thermocouple and a digital manometer, respectively.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs across each segment was determined by multiplying model facility costs by the number of facilities in the industry and determining total costs from the entire segment. This was done for only those facilities that exceed the reporting threshold. Then cost per facility was determined by dividing the total segment costs by the number of facilities that exceed the reporting threshold.

5. SUBPART K—FERROALLOY PRODUCTION

Model Facility Development

For the Ferroalloy Production subpart, one model facility was developed using a facility-level inventory for 2006, which represented the known universe of 9 separate ferroalloy production facilities. Two costing options were evaluated.

Option 3b (the selected option) assumes that each facility will determine the emissions by conducting a monthly carbon balance. Facilities determine carbon contents through analysis of representative samples of the material. These materials include coal, coke, electric arc furnace (EAF) carbon electrodes, EAF charge carbon, fuel oil, and gas coke. In addition, the quantities of these materials consumed and produced are measured and recorded. The average carbon content is then multiplied by the amount (mass) of each material assuming that all of the carbon is converted during the process. The difference between the calculated total carbon input and the total carbon output is the estimated CO_2 emissions to the atmosphere.

Option 3a assumes that each facility will use the carbon content supplied with the shipment of each material. This option also assumes that each facility will perform quality assurance/quality control checks on each material once per year.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3b:
    i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours. Continued yearly costs related to the monitoring plan equal 4 hours for an industrial engineer/technician, 2 hours for an industrial manager, and 1 hour for a lawyer to review.
    ii. Monitoring costs (for sampling and analysis) total $8,066 in the first year and $7,514 in subsequent years. These costs assume that the industrial engineer/technician will need 4 hours in the first month and 2 hours for the subsequent months for testing each of the five materials for a total of $7,176 in the first year and $6,624 in each subsequent year. The costs also assume administrative assistance will be needed for 0.5 hours per month for each of the five materials for a total of $890 per year. Similarly, the O&M costs total $12,000 per facility for performance testing, which includes $200 per month for each of the five materials.
    iii. Reporting costs total $0 because annual reporting of test results is not required.

b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3a:

   i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours. Continued yearly costs related to the monitoring plan equal 4 hours for an industrial engineer/technician, 2 hours for an industrial manager, and 1 hour for a lawyer to review.

   ii. Monitoring costs (for sampling and analysis) total $221 in the first year and $110 in subsequent years. These costs assume that the industrial engineer/technician will need 4 hours in the first year and 2 hours for the subsequent years for testing each of the five materials. Similarly, the O&M costs total $1,000 per facility for performance testing, which includes $200 per year for each of the five materials.

   iii. Reporting costs total $0 because annual reporting of test results is not required.

Assigning Costs to Cost Elements

Option 3b

Table 5-1.

Subpart Z—Phosphoric Acid Production	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													130	120	30	30	$8,065.50	$7,513.50
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	146	124	30	30	$9,618	$7,977

Table 5-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				0	$0	$0
Performance testing				$12,000	$12,000	$12,000
Recordkeeping				0	$0	$0
Travel				0	$0	$0
Total			$0	$12,000	$12,000	$12,000

Option 3a

Table 5-3.

Subpart Z—Phosphoric Acid Production	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													4	2			$220.80	$110.40
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	20	6	0	0	$1,773	$574

Table 5-4.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				0	$0	$0
Performance testing				$1,000	$1,000	$1,000
Recordkeeping				0	$0	$0
Travel				0	$0	$0
Total			$0	$1,000	$1,000	$1,000

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

6. SUBPART L—FUGITIVE EMISSIONS FROM PRODUCTION OF FLUORINATED GHG

Table 6-1. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities
1,000	18
10,000	12
25,000	12
100,000	10

STEP 1: Model Facility Development

The model fluorinated GHG production facility is one that produces fluorinated GHGs, including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3), and a number of fluorinated ethers. Fluorinated GHGs can escape during the production process. Emissions can occur from leaks at flanges and connections in the production line, from byproduct streams that are imperfectly separated from the main product stream, and during the filling of tanks or other containers to be shipped on trucks and railcars. These are considered fugitive emissions from the production process. For the purposes of estimating costs, the single model is a facility that produces fluorinated GHGs.

Fugitive emissions are calculated using a mass-balance or yield approach. In this approach, emissions are equated to the difference between the expected production of each fluorinated GHG based on the consumption of reactants and the measured production of that fluorinated GHG, accounting for yield losses related to byproducts and wastes.

Under the proposed rule, owners or operators would be required to use scales and/or flowmeters with an accuracy of 0.2% of full scale to measure reactants, products, byproducts and wastes. In addition, they would be required to perform daily mass balance calculations for each product produced. In this calculation, they would be required to account for any product that was inadvertently mixed into the byproducts or wastes using equipment and methods (e.g., gas chromatography) with an accuracy of 5% or better at the concentrations of the process samples.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking can be broken into four elements, each of which is described below.

1. Regulation compliance determination costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate regulation compliance determination costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.
2. Monitoring costs. EPA's understanding is that plants already perform the proposed measurements and calculations to monitor their processes and yields. Plants already possess, maintain, and calibrate highly accurate weigh scales and/or flowmeters, and they already perform daily and monthly mass-balance assessments for each product. Thus, no capital costs for monitoring equipment are attributed to the rule, and no annual costs for calibrating equipment or for estimating process losses are attributed to the rule.
3. Reporting costs. The reporting costs associated with complying include annual labor hours for pulling the annual value of the data records already measured by an instrument.
4. Recordkeeping costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate recordkeeping costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

There is a single model facility type for fugitive emissions from industrial gas supply; thus, there was no need to apportion facilities to different model facility levels.

STEP 4: Assigning Costs to Cost Elements

The assignment of costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements, if applicable.

These steps are described in further detail below.

►Determining Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, two labor categories were used as shown in Table 6-2.

Table 6-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate (2006$/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour

►*Allocating Responsibilities*

Assigning labor hours for all cost elements was based on expert judgment. Table 6-3 summarizes the allocation of hours and responsibilities by labor category.

Table 6-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Managerial		Technical		Per Facility/ per Company
	Activity	Hours	Activity	Hours	
Regulation Compliance Data					
None estimated					
Monitoring					
None					
Reporting					
Retrieval of production and concentration information for reporting.	Oversees the retrieval process to ensure for completeness and accuracy.	1	Compile production and concentration information for reporting.	3	
Recordkeeping					
None estimated					

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. No additional costs are assumed.

►*Capital Cost Annualization and O&M Costs*

Since it is already standard procedure to meter or record fugitive emissions from industrial gas supply, there are no capital costs related to monitoring emissions and archiving of information, and therefore there are no associated O&M costs.

In the event that a plant does not possess highly accurate flowmeters or scales, the plant would be required to acquire them at an installed cost of approximately $20,000 per flowmeter. However, as discussed above, EPA believes that plants producing fluorinated GHGs already use highly accurate flowmeters and/or scales.

STEP 5: Estimate per Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements (Table 6-3), they were multiplied by the associated labor rates (Table 6-2) to estimate labor costs per facility activity. Finally, this unit cost was multiplied by the number of facilities in the segment (Table 6-1), i.e., the number of facilities that exceed the reporting threshold, to determine the total national costs per year for this sector.

7. SUBPART M—FOOD PROCESSING WASTEWATER TREATMENT

STEP 1: Model Facility Development

For this source category, EPA evaluated food processing wastewater treatment plants, including meat processors, poultry processors, and fruit/vegetable processors to represent the types of wastewater treatment systems with the greatest potential to exceed the GHG threshold.

EPA first attempted to locate any plant-level datasets that would allow direct calculation of greenhouse gas emissions by plant. Where plant-level data were incomplete, EPA used default national-level data from the National Inventory to fill in missing data. Where plant-level data were unavailable, EPA instead determined the production levels for each industry that would trigger emissions over any of the thresholds of interest, and used best professional judgment to estimate how many plants would meet the production levels.

’ EPA was unable to obtain a dataset containing plant-specific information for meat processors or poultry processors. Therefore, using national default values for wastewater generation, COD in wastewater rates, and assuming all wastewater is treated anaerobically on site, ERG back-calculated the production rate that would trigger each of the four emission thresholds, shown in Table 7-1.

Because of the decentralized and variable nature of the fruits and vegetables processing industry, EPA was unable to obtain a dataset containing plant-specific information to calculate greenhouse gas emissions for fruit and vegetable processors. The national level of emissions from the National Inventory is 123,000 tCO_2e. From the National Inventory, approximately 100 processors have onsite anaerobic treatment; therefore, the average emission is about 1,200 tCO_2e per plant. Therefore, EPA does not believe there are many, if any, fruit and vegetable processors that would exceed thresholds greater than 10,000 tCO_2e. However, up to 100 processors may exceed the 1,000 tCO_2e based on the average emission rate.

Table 7-1. Threshold Production Levels for Meat and Poultry Processors

Threshold (tCO_2e)	Meat Processing Production		Poultry Processing Production	
	Thousand Metric Tons	Million Lbs.	Thousand Metric Tons	Million Lbs.
1,000	5	12	4	9
10,000	53	117	42	93
25,000	133	292	105	232
100,000	531	1,170	421	928

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs.

1. Regulation Study and Review and Registration costs are not discussed in this appendix. Instead, please refer to Section 4.2 of the RIA.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs. Capital investment will be required for purchasing monitoring equipment. This capital cost will be accounted as annualized cost on an annual basis. Labor will be required for product research for monitoring instruments before actual purchase. Before actual monitoring takes place, labor will have to be devoted to the development of a monitoring plan. EPA assumed that each plant would develop its own monitoring plan, and that selected employees are already trained on how to use the monitoring equipment.
    b. Recurring monitoring costs consist of labor required to conduct detection and measurement of emissions (i.e., perform actual monitoring of emissions). EPA assumed that each plant would conduct monitoring onsite.
3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in registration.
    b. Recurring reporting costs consist of labor necessary to document collected emissions data from fugitive emissions monitoring and to submit the official report in each cycle (i.e., annually).
4. Archiving and recordkeeping costs and auditing costs are not included in this appendix. Instead, please refer to Section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

EPA estimated the number of food processing plants that would exceed production levels that would trigger emissions over any of the thresholds of interest. In these cases, EPA used best professional judgment to estimate how many plants would meet the production levels.

For meat and poultry processors, EPA used data collected by EPA's Office of Water (OW) in 2004 to establish national effluent limitation guidelines and standards. These data provided EPA with the basis to estimate the number of plants that would exceed the production levels that trigger the threshold. As discussed in Step 1, EPA assumed there were no fruit and vegetable processors that would exceed the threshold based on national estimates of emissions.

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►***Determining Labor Categories***

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, three labor categories were used as shown in Table 7-2.

Table 7-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Industrial Manager	Oversees Technician and Operator activities, including reviewing monitoring plan and emissions estimates.	$71.03/hour
Plant and System Operator	Develops monitoring plan and conducts monitoring of wastewater. Gathers plant data and estimates emissions.	$36.29/hour
Industrial Engineer/Technician	Conducts monitoring of emission sources (i.e., digester systems).	$55.20/hour

►Allocating Responsibilities

Assigning labor hours for all cost elements was based on expert judgment. Annual costs for wastewater sampling includes the labor to collect samples, calculate emissions, and report the results. EPA assumes that wastewater samples and emission calculations will be performed by a Plant and System Operator. These operators are already familiar with conducting wastewater testing, including BOD, suspended and dissolved solids, and dissolved oxygen, and record the results in standardized reports designed to meet Federal and State regulations.

EPA estimates that two hours of labor is needed per month to collect and organize flow data, for a total annual cost of $871. EPA estimates that 1 hour of labor is needed for each sampling episode. Each COD wastewater sample is estimated to have analytical costs of $30, based on an average of laboratory rate schedules. EPA assumed monthly sampling episodes, which results in an annual sampling cost of $795.

Facility staff will need to calculate and report emissions once per year, using flow and COD data gathered. EPA assumes this effort will require 8 hours for an operator, with 1 hour of supervisory review, with a total annual cost of $361.

The annual cost to operate the continuous measurement system includes the cost to calibrate the analyzers monthly and to compile annual emission reports. These tasks are assumed to require 14 hours a year of an industrial technician. The annual costs also include $200 for gas analyzer calibration kits. The total annual costs including labor and calibration kits are $973.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are due to the annualized capital costs.

►***Capital Cost Annualization and O&M Costs***

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection, emissions measurement, and information storage. All costs are reported in 2006 U.S. dollars and annualization was assumed over an equipment life of 20 years with a 7% interest rate. From these factors, a capital recovery factor of 9.4% was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 7-3 below summarizes the capital costs associated with the monitoring program.

Table 7-3. Monitoring Program Compliance Capital Costs and Other O&M

Element	Capital Cost	Annualized Capital Cost
Archiving		
Capital Costs	Cost of archiving material per facility assumes cost of 1 file cabinet, 4-drawer vertical from Office Depot™ ($140), and 1 hard drive for data storage from Seagate™ ($95)	$57
Monitoring		
Equipment Purchase	Continuous gas composition monitoring equipment for anaerobic digestion systems would require a continuous gas composition analyzer, a temperature sensor, a gas pressure sensor, and a data logger	$3,640

The two primary instruments used in the continuous measurement method are an in-line gas flow meter and an in-line gas composition meter. EPA assumes industrial wastewater treatment plants that are using digesters already have an in-line gas flow meter. The instruments available for continuously measuring the methane content of biogas include the Guardian Plus by Topac and the GA-2000 by Geotechnical Instruments.

The temperature and pressure of the gas flowing through the instruments must also be measured. These two parameters are generally measured with a thermocouple and a digital manometer, respectively.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs across each segment was determined by multiplying model facility costs by the number of facilities in the industry and determining total costs from the

entire segment. This was done for only those facilities that exceed the reporting threshold. Then cost per facility was determined by dividing the total segment costs by the number of facilities that exceed the reporting threshold.

8. SUBPART N—GLASS PRODUCTION

Model Facility Development

The Glass Manufacturing subpart cost analysis was conducted using a model facility which assumed that each of the 374 known facilities operate with only one process line. The selected reporting option for glass manufacturing depends on whether the facility currently uses CEMS. Facilities which already have CEMS in place should monitor GHG emissions using CEMS; otherwise, process emissions are monitored using a carbonate input approach (combustion emissions are not addressed in this subpart).

For Option 1, the proposed monitoring method, the facility does all sampling and determines carbon content on-site. Process emissions are estimated by measuring the quantity of carbonate inputs to the furnace and applying the appropriate emission factors and calcination fractions to the carbonates consumed/volatized.

Option 2, like Option 1, estimates process emissions by measuring the quantity of carbonate inputs to the furnace and applying the appropriate emission factors and calcination fractions to the carbonates consumed. However, carbonate input compositions are quantified by sending samples of process inputs to an off-site laboratory for analysis on a monthly basis.

Option 3 is an input based option similar to Options 1 and 2; however, the facility would receive carbonate compositions from the supplier instead of sending samples to an off-site vendor for routine calculations. Additionally, a composite sample of the carbonate input is sent to an off-site vendor once per year to verify supplier reported values.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs

    i. Initial costs are associated with developing the methodology and monitoring plan for calculating emissions from the production process. Planning in the first year would take an average of 8 hours from an industrial manager, 16 hours for the industrial engineer/technician and one hour for lawyer review; this applies to each of the options. Planning in subsequent years would take an average of 2 hours from an industrial manager, 4 hours for the industrial engineer/technician and one hour for lawyer review; this applies to each of the options.

    ii. Monitoring costs are for determining the carbon content of input/output materials. Options 1, 2, and 3 require sample collection by the industrial engineer/technician. In the first year, the sampling averages 6 hours for the annual sampling procedures in Option 1, 26 hours for the monthly sampling in Option 2, and 5 hours for the yearly composite sampling procedures in Option 3. In subsequent years, the sampling averages 4 hours for the annual sampling

procedures in Option 1, 24 hours for the monthly sampling in Option 2, and 4 hours for the yearly composite sampling procedures in Option 3.

1. Option 1 requires an annual composite sample of the input to be analyzed on-site for carbon content; the cost for supplies is estimated to be $50.
2. Option 2 requires samples to be sent off-site for analysis monthly which will cost an average of $200 per sample, $2,400 annually.
3. Option 3 requires off-site sampling once per year to verify carbon content reported by the suppliers; this cost is estimated to be $200.

iii. Reporting costs were only included for Option 2, assuming that administrative staff would need an average of 6 hours per year. It was assumed that recordkeeping costs would be minimal for all three options.

Assigning Costs to Cost Elements

Option 1

Table 8-1.

Subpart N—Option One: On-site sampling; per material (Annual)	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													6	4			$331.20	$220.80
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	22	8	0	0	$1,883.64	$684.66

Table 8-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$50	$50	$50
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total			$0	$50	$50	$50

Option 2

Table 8-3.

Subpart N—Option Two: Off-site Sampling (Monthly)	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													26	24			$1,435.20	$1,324.80
Reporting															6	6	$177.90	$177.90
Total	0	0	0	0	8	2	1	1	0	0	0	0	42	28	6	6	3165.54	1966.56

Table 8-4.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing				$2,400	$2,400	$2,400
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$2,400	$2,400	$2,400

Option 3

Table 8-5.

Subpart N- Option Three: Request C-content from supplier (Quarterly)	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC													4	2			$220.80	$110.40
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													5	4			$276.00	$220.80
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	25	10	0	0	$2,049.24	$795.06

Table 8-6.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing				$200	$200	$200
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$200	$200	$200

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

9. SUBPART O—HCFC-22 PRODUCTION

Table 9-1. Number of Representative Affected Entities Used in the Cost Analysis.

Threshold	Number of Representative Entities
1,000	3
10,000	3
25,000	3
100,000	3

STEP 1: Model Facility Development

Three HCFC-22 production facilities operated in the United States in 2006. For the purpose of estimating costs, a model facility was developed by taking the average of facility-specific cost estimates; the facility-specific cost estimates vary primarily depending on the process architecture of each facility. Hence, the model facility is an average facility that incurs the average of costs across all facilities.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into four elements, each of which was taken into consideration for this sector.

1. Regulation compliance determination costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate compliance determination costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.
2. Monitoring costs. The following types of monitoring costs were identified for areas in which the methods go beyond current practice at one or more of the facilities already estimating HFC-23 emissions and assuring the quality of these estimates:
    i. Application of bias factor to compensate for fugitive losses of product. In the proposed rule, facilities that use product (HCFC-22 or HCl) masses or mass flow rates to estimate HFC-23 generation and that measure those masses or mass flow rates significantly downstream of the reactor would be required to add 1.5% to their mass or mass flow rate measurements to account for upstream product losses, which are estimated to range from one to two percent. Without the adjustment, HCFC-22 production and therefore HFC-23 generation at affected facilities would be systematically underestimated (negatively biased). EPA's understanding is that one facility measures the product mass significantly downstream of the reactor. The application of the bias factor is assumed to require

negligible time during the HFC-23 emissions estimation procedure and is therefore not estimated in EPA's cost analysis.

ii. Calibration of gas chromatographs using standards with representative concentrations. In the proposed rule, HCFC-22 production facilities would have to calibrate gas chromatographs used to determine the concentration of HFC-23 by analyzing certified standards with known HFC-23 concentrations that are in the same range (percent levels) as the process samples. This proposed requirement is intended to verify the accuracy of gas chromatographs at the concentrations of interest; calibration at other concentrations does not verify this accuracy with the same level of assurance. The proposed requirement is similar to requirements in protocols for the use of gas chromatography, such as EPA Method 18. While one affected facility currently calibrates its gas chromatograph in this fashion, the other does not. Thus, the second facility would incur costs to change its calibration practices.

iii. Accounting for emissions during startups, shutdowns, and malfunctions. In the proposed rule, facilities would be required to account for HFC-23 production and emissions that occur as a result of startups, shutdowns, and malfunctions, either recording HFC-23 production and emissions during these events or documenting that these events do not result in significant HFC-23 production and/or emissions. This proposed requirement would result in costs associated with a change in practice of one facility.

iv. Increasing frequency to daily measurements of the process stream. In the proposed rule, facilities not using a thermal oxidizer connected to the HCFC-22 production equipment would be required to measure HFC-23 concentrations and product flow rates on at least a daily basis. This proposed requirement is intended to account for day-to-day fluctuations in the rate at which HFC-23 is generated; this rate can vary depending on process conditions. While one affected facility measures these quantities several times an hour, the other measures them twice per week. Thus, the second facility would incur costs associated with increasing the frequency of its measurements.

v. Annual check of thermal oxidizer. In the proposed rule, facilities using thermal oxidizers would have to perform annual HFC-23 concentration measurements by gas chromatography to confirm that emissions from the oxidizer are as low as expected based on the rated DE of the device. Although the initial testing and parametric monitoring that facilities currently perform on their oxidizers provides general assurance that the oxidizer is performing correctly, the proposed requirement would provide additional assurance at relatively low cost. Even a one- or two-percent decline in the destruction efficiency of the oxidizer could lead to emissions of over 100,000 $mtCO_2e$, making this a particularly important factor to monitor accurately. This proposed requirement would lead to a change in the practice of at least one facility, with associated increase in cost.

vi. Annual monitoring of emissions from process vents. In the proposed rule, HCFC-22 production facilities that use a thermal oxidizer connected to the HCFC-22 production process would be required to conduct annual monitoring of HFC-23

emissions from process vents. Although HFC-23 emissions from process vents are believed to be quite low, this monitoring would ensure that any year-to-year variability in the emission rate was captured by the reporting. Like the annual check on the thermal oxidizer, this requirement would cost relatively little. The proposed requirement would lead to a change in the practice at one facility.

3. Reporting costs. Though it's already standard procedure to meter or record production levels, someone at each facility would need to be tasked annually with going to the right computer and pulling the annual value of that statistic. The process of compiling production and concentration information for reporting will represent a change in practice at each of the facilities.
4. Recordkeeping costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate recordkeeping costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

This step is not applicable to this sector because the model facility was constructed as one average facility that is applicable to all U.S. HCFC-22 production facilities.

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►Determine Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, three labor categories were used as shown in Table 9-2.

Table 9-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour
Clerical	Assists with documentation and recording information.	$29.65/hour

►***Allocate Responsibilities and Estimate Labor Hours***

The assignment of labor hours for all cost elements was based on expert judgment. Table 9-3 summarizes the allocation of hours and responsibilities by labor category.

Table 9-3. Responsibilities for Regulation Compliance by Labor Category

	Responsibilities and Hours by Labor Category						
	Managerial		Technical		Clerical		Per Facility/ Per Company
Cost Element	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Regulation Compliance Data							
None estimated							
Monitoring							
Calibration of gas chromatographs using standards with representative concentrations.	Provide quality assurance of analyses and authorize completeness of the checks.	4	Perform monthly checks of accuracy of the measurements of the ratio of HFC-23 to HCFC-22 by analyzing standards with known concentrations that are in the same range (percent levels) as the process samples.	30			One facility
Accounting for emissions during startups, shutdowns, and malfunctions.					Records and documents SSM events specifying if they result or do not result in excess emissions and include the SSM emission estimates in the emissions inventory	75	One facility

(continued)

Table 9-3. Responsibilities for Regulation Compliance by Labor Category (continued)

Cost Element	Responsibilities and Hours by Labor Category						
	Managerial		Technical		Clerical		Per Facility/ Per Company
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Increasing frequency to daily measurements of the process stream.			Monitor process stream on a daily basis	208			One facility
Annual check of thermal oxidizer.			Perform annual measurements by gas chromatography to ensure that the thermal oxidizer is functioning properly	2			Two facilities
Annual monitoring of emissions from process vents.			Perform annual HFC-23 concentration measurements by gas chromatography at the outlets of the process vents.	4			One facility
Reporting							
Retrieval of production and concentration information for reporting.	Oversees the retrieval process to ensure for completeness and accuracy.	1	Compile production and concentration information for reporting.	3			Three facilities
Recordkeeping							
None estimated							
Total hours, weighted average for all facilities							
		2.3		85		25	

Some additional explanation and information associated with determining the hours and allocation of responsibility is provided below.

- § Calibration of gas chromatographs using standards with representative concentrations. The assumption that monthly calibration will require 30 hours of technical labor and 4 hours of managerial labor may be an overestimate, since some calibration of gas chromatographs already occurs at the affected facility.
- § Accounting for emissions during startups, shutdowns, and malfunctions. This activity was assumed to require 75 hours of clerical time per year based on the understanding that the relative frequency is approximately 60 hours of startup and shutdowns per year and 15 malfunction events per year.
- § Increasing frequency to daily measurements of the process stream. The increase in frequency is from three times a week to every day; therefore, assuming it takes 1 hour per sample, four additional samples per week were assumed (i.e., 52 × 4 = 208 hours).

- Annual monitoring of emissions from process vents. This activity was assumed to be required for two process vents, with each requiring 2 hours each to perform annual HFC-23 concentration measurements using gas chromatography.

►***Capital Cost Annualization and O&M Costs***

Because HFC-23 is generally an unwanted byproduct of HCFC-22 production, HFC-23 generation is closely tracked to maximize the efficiency of the HCFC-22 production process. Thus, many of the activities in the methods to monitor for HFC-23 emissions are already occurring, and are not attributed to the proposed rule. Therefore, the costs of devices used to monitor HFC-23 concentrations in process or emission streams and on measurements of the flow rates of those streams are not associated with any additional instrumentation capital costs. Nonetheless, EPA's understanding is that scales and flowmeters with considerably better accuracies are available and that the installed cost of the more accurate flowmeters is approximately $20,000 per flowmeter. EPA is considering the option of requiring facilities to use flowmeters or scales with an accuracy of 0.2% or some other accuracy better than 1 percent; however, the costs for purchasing and installing flowmeters that are more accurate than those used in some facilities are not factored into this cost analysis.

The methods analyzed are very similar to the procedures already being undertaken by the plants to estimate HFC-23 emissions and to assure the quality of these estimates. There are no associated O&M costs.

STEP 5: Estimation of Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements (as shown in Table 9-3), they were multiplied by the associated labor rates (as shown in Table 9-2) to estimate labor costs per facility. The unit cost per entity was multiplied by three, i.e., the number of facilities that exceed the reporting threshold, to determine the total national costs per year for this sector.

10. SUBPART P—HYDROGEN PRODUCTION

Costs were developed for monitoring at merchant hydrogen production facilities. Merchant hydrogen is consumed at sites other than where it is produced. Merchant hydrogen production facilities purchase a hydrocarbon feedstock, and may sell CO_2 over the fence as well as hydrogen.

By definition, merchant hydrogen production is distinct from captive hydrogen production. Captive hydrogen (e.g., hydrogen produced at oil refineries, ammonia, methanol, and chlorine plants) is consumed at the site where it is produced. This cost estimate assumes that CO_2 emissions associated with captive hydrogen production facilities (if any) are included as part of the GHG emissions from the industry producing those other chemical products (e.g., ammonia, petroleum products, methanol, and chlorine), and therefore this document is focused on merchant hydrogen production.

The monitoring approach is a hybrid method which combines direct measurement by continuous emissions monitoring system (CEMS), where CEMS components are currently employed for other purposes, and the fuel and feedstock mass balance approach at facilities where CEMS are not currently employed or at facilities where combustion or process CO_2 emissions are emitted via secondary stacks or vents. CEMS-method facilities will have CO_2 monitoring in place and will retrofit CEMS by installing a stack flow meter. CEMS costs have been addressed under Stationary Combustion in the RIA, consequently, this cost analysis is focused on only those facilities that will use the fuel and feedstock mass balance approach.

Cost estimating methodology and results for the merchant hydrogen production category are summarized in this section.

1. Model Facility Development

The estimated 77 merchant hydrogen production facilities in the United States range in capacity from around 6 to almost 200,000 metric tons of hydrogen per year. Even so, the same amount of data is collected for each facility, and therefore the monitoring cost for each site is the same.

The feedstock mass balance cost data are calculated for merchant hydrogen production facilities using natural gas, other hydrocarbon gases and liquids, and solid fuels (coal, pet coke) as feedstock. For this analysis, there is no distinction in the feedstock mass balance cost data for the various feedstock materials.

The following broad assumptions were made for this cost analysis:

- Merchant hydrogen production process is one of the following:
  - Steam methane reforming
  - Steam reforming other gas and liquid hydrocarbons
  - Partial oxidation of gas and liquid hydrocarbons
  - Coal gasification
- Facility capacity is 40,000 tons of hydrogen per year
- Fuel and feedstock quantities are normally determined as part of custody transfer
- Fuel and feedstock suppliers will readily provide carbon content of feedstock
- No additional O&M and QC/QA costs for fuel and feedstock measurements
- CO_2 may be sold over the fence
- Quantity and purity of CO_2 sold is normally determined as part of custody transfer
- No additional O&M and QC/QA costs for CO_2 flow meter and purity measurements

2. Determine Cost Elements

For the merchant hydrogen production category, total costs associated with complying with the proposed rulemaking were broken into four elements.

- Regulation compliance determination costs
- Monitoring costs
- Reporting costs
- Recordkeeping costs

These cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the monitoring and reporting process. Subsequent costs for reporting on an annual basis are less than the first-year startup costs and are referred to as recurring costs. Costs elements for this monitoring option are determined as follows:

- Regulation compliance determination costs
  For the merchant hydrogen production category, no additional costs were assumed beyond the generic regulation compliance determination costs applied to all source categories.
- Monitoring costs

The cost estimate for the feedstock mass balance method applies the feedstock mass balance approach at all merchant hydrogen production facilities, including facilities where

combustion or process CO_2 emissions are emitted via secondary stacks or vents. The feedstock mass balance cost data are calculated for merchant hydrogen production facilities using natural gas, other hydrocarbon gases and liquids, and solid fuels (coal, petroleum coke) as feedstock. For this analysis, there is no distinction in the feedstock mass balance cost data for the various feedstock materials.

The following assumptions were made regarding the activities and the cost of the monitoring method in order to prepare the cost estimates shown in Table 10-1 and Table 10-2:

- Facility will internally develop the details of the monitoring plan for calculating emissions in the first year and update the plan in subsequent years for feedstock method
- Facility managers will review samples per sampling period per facility, including manager's review of data collection and processing
- Feedstock-method facilities will contact feedstock supplier (e.g., the local gas distribution utility) annually to request monthly average data for average carbon content of the fuel and feedstock delivered during the prior year
- Annually, the feedstock-method facilities will QA/QC suppliers information on carbon content and CO_2 reports by sending a feedstock sample off-site for analysis
- Annually the feedstock-method facility managers will review samples per sampling period per facility

These required activities will involve labor hours for industrial managers, industrial engineers/technicians, and lawyers. The required labor hours and average rates for these individuals are presented in Table 10-1. These labor hours are based on estimates of the number of direct technical hours needed to perform a required activity, under the assumptions that:

- The carbon content data is readily available from the fuel and feedstock suppliers
- The merchant hydrogen production facility has detailed data on the amount of fuel and feedstock used at the facility
- The amount and purity of CO_2 delivered off-site and sold to other industrial facilities is measured as a normal part of doing business.

Also, for the feedstock method, there will be no capital equipment costs and no operations and maintenance costs beyond normal business practices for the facility (with one exception: an annual off-site test of feedstock carbon content for QA/QC purposes).

Table 10-1. Labor Costs for Mandatory GHG Reporting Process Related Emissions from Merchant Hydrogen Production

Activity	Labor Hours						Labor Cost per Year per Reporting Unit/ Facility (2006$)	
	Industrial Manager ($71.03/hr)		Industrial Engineer/ Technician ($55.20/hr)		Lawyer ($101.00/hr)			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning—Internally develop the methodology and monitoring plan for calculating emissions from production process per facility—first year is developing plan, subsequent years are reviewing and updating plan.	8	2	16	4	1	1	$1,552	$464
Sampling and Analysis—Contact feedstock supplier for C content [a]; aggregate feedstock purchase and CO_2 sales records annually.	—	—	7	4	—	—	$386	$221
QA/QC—Send feedstock sample for off-site analysis once per year; QA/QC information on C content.	—	—	11	4	—	—	$607	$221
Manager's Review—Review data collection, data processing, and data products.	8	8	—	—	—	—	$568	$568
Totals	**16**	**10**	**34**	**12**	**1**	**1**	**$3,114**	**$1,474**

[a] E.g., the technician contacts the local gas distribution utility annually to request monthly average gas composition data for prior year.

The total annual costs per facility are presented in Table 10-2. The first year is more expensive since it includes the one-time labor to establish a monitoring plan and the start-up costs for monitoring and QA/QC.

- Reporting costs
  For the merchant hydrogen production category, no additional costs were assumed beyond the generic reporting costs applied to all source categories.
- Recordkeeping costs
  For the merchant hydrogen production category, no additional costs were assumed beyond the generic recordkeeping costs applied to all source categories.

Table 10-2. Total Monitoring Costs for Reporting of Process Emissions from Merchant Hydrogen Production

Activity	Cost of Monitoring Instruments				Total Reporting per Unit/Facility Cost (2006$) [a]	
	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/ year)	O&M Costs (2006$/ year)	First Year	Subseq. Year
Planning—Internally develop the methodology and monitoring plan for calculating emissions from production process per facility—first year is developing plan, subsequent years are reviewing and updating plan	—	—	—	—	$1,552	$464
Sampling and Analysis—Contact feedstock supplier for C content[b]; aggregate feedstock purchase and CO_2 sales records annually	—	—	—	—	$386	$221
QA/QC—Send feedstock sample for off-site analysis once per year; QA/QC information on C content	—	—	—	$200	$807	$421
Manager's Review—Review data collection, data processing, and data products	—	—	—	—	$568	$568
Annual Costs					**$3,314**	**$1,674**

[a] Based on assumptions in prior table for labor costs for each activity.

[b] E.g., the technician contacts the local gas distribution utility annually to request monthly average gas composition data for prior year.

3. Analyze Proportion of Facilities in the Different Model Facility Levels

Monitoring costs are the same for all sites since the same amount data are collected for each facility. Consequently, model facilities were not used for proportioning facilities.

4. Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►*Determining Labor Categories*

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the purposes of this analysis, three labor categories were used as shown in Table 10-3.

Table 10-3. Labor Costs and Labor Hours Used in the Analysis

Labor Category	Loaded Hourly Rate (2006$)
Industrial Manager	$71.03
Lawyer	$101.00
Industrial Engineer/Technician	$55.20

Notes:

* These rates reflect adjustments of manufacturing sector's average productivity increase of 3.7% per year for 6 quarters between 2006 Q2 and 2007 Q4, based on the estimate released by the Bureau of Labor Statistics in March 2008.

2006 Q2 labor rates were obtained from the ICF Nov, 2007 report.

Refer to ICF Nov. 2007 Report's supporting documentation for details on the wage rate calculation methodology.

Source:

Supporting Document for "Mandatory GHG Reporting Burden Assessment—Preliminary Draft," ICF, 2007.

Productivity and Costs, Fourth Quarter and Annual Averages, 2007. Revised, Bureau of Labor Statistics, March 5, 2008.

►*Allocating Responsibilities*

Assigning labor hours for all cost elements was based on expert judgment. When assigning hours, the role of the labor categories were taken into consideration. Table 10-4 summarizes these roles.

Table 10-4. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer/ Technician**	**Administrative Support**	**Per Facility/ Per Company[a]**
Monitoring [b]					
Planning	First Year: Review methodology and monitoring plan; Subseq. Years: Review updated plan	Each Year: Legal review of monitoring plan	First Year: Determine methodology and prepare monitoring plan; Subseq. Years: Update plan		Per facility
Sampling and Analysis			Each Year: Contact feedstock supplier for monthly carbon content data; Aggregate monthly feedstock purchase and CO_2 sales records		Per facility
QA/QC			Each Year: Send feedstock sample for off-site analysis; Perform QA/QC on data from supplier and from monthly feedstock purchase and CO_2 sales records		Per facility
Manager's Review	Each Year: Review data collection, data processing, and data products				Per facility

[a] Each of the 77 existing merchant hydrogen production facilities is considered to be separate operating entity.

[b] Regulation compliance determination costs, as well as reporting and recordkeeping costs are applied uniformly to all source categories across the rule.

Table 10-5 summarizes the labor cost and labor hours per labor category for the first year and for subsequent years. Labor requirements for this option were estimated based on engineering estimates of the number of direct technical hours (i.e., industrial manager labor hours and industrial engineer/technician labor hours) needed to perform a required activity.

Table 10-5. Summary of Labor Hours Used in Analysis

Industrial Source Category	Operating Period	Total Annual Labor Hours			
		Industrial Manager	**Industrial Engineer**	**Lawyer**	**Admin Support**
Merchant Hydrogen Production	First year	16	34	1	0
	Subsequent years	10	12	1	0

Table 10-6 summarizes the monitoring costs for this option.

Table 10-6. Summary of Monitoring Cost and Uncertainty for Merchant Hydrogen Production

Source Category	Monitoring Option or GHG Calculation Method	Sources of Accuracy/ Uncertainty Considered	Level of Accuracy/ Uncertainty	Annualized Cost per Facility (2006$/year)	Method Complexity	Is the Method Commonly Required by Other Programs
Merchant Hydrogen Production	Feedstock mass balance	Measurement method	High accuracy; uncertainty ± 2%	First year: $3,314; Subseq. years: $1,674	Low	No

►***Capital Cost Annualization and O&M Costs***

No capital costs or O&M costs are associated with this monitoring option. Therefore no capital cost annualization was conducted for this option. The necessary flow meters (for feedstock purchased and CO_2 sold over the fence) are assumed to be already installed and being operated at the existing facilities. Also, any O&M costs associated with these existing feedstock and CO_2 flow meters are already being incurred. Therefore, no incremental O&M costs for the feedstock flow meters and CO_2 flow meters are assumed to be associated with the monitoring requirements.

5. Estimation of Facility Costs for Each Threshold Level

There are no threshold levels for the merchant hydrogen production category. All existing merchant hydrogen production facilities would incur similar monitoring costs.

6. Nationwide Cost Estimates for Proposed Option

A nationwide cost estimate was developed for this monitoring option and is provided in Table 10-7. The national cost to implement the hybrid CEMS-feedstock mass balance approach depends on the current mix of CEMS equipment installed at the 77 merchant hydrogen production facilities. EPA has insufficient information to assess this equipment mix, and consequently, the distribution of facilities was assumed to be a 50-50 split between those who have CEMS and those who do not. Using the feedstock mass balance method, the monitoring costs are the same for all existing sites; therefore, the total monitoring cost is the cost for a single facility multiplied ($3,314 for first year, and $1,674 for subsequent years) by half the number of facilities (38.5).

Table 10-7. Nationwide Costs for Regulatory Alternative

Industrial Source Category	Proposed Monitoring Option	Number of Reporting Facilities	Total Nationwide Annualized Cost (2006$/yr)	
			First Year	Subsequent Years
Merchant Hydrogen Production	Feedstock mass balance	38.5	$127,589	$64,449

11. SUBPART Q—IRON AND STEEL PRODUCTION

Model Facility Development

For the Iron & Steel subpart, model facilities were not developed due to insufficient data for differentiating costs for compiling data and conducting sampling across different facilities. Instead, site-specific data was used to calculate the cost for each process. Three Options were considered, and are discussed below.

Option 1 requires that a monthly carbon balance of all inputs and outputs be performed using measurements of the carbon content of specific process inputs and process outputs and measure the mass rate of process inputs and process outputs. The next step is calculation of CO_2 emissions from the difference of carbon-in minus carbon-out assuming all is converted to CO_2.

Option 2 requires the development of a site-specific emission factor based on simultaneous and accurate measurements of CO_2 emissions and production rate or process input rate during representative operating conditions.

Option 3 requires direct and continuous measurement of CO_2 emissions using a continuous emission monitoring system for CO_2 concentration and stack gas volumetric flow rate.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 1, the selected option.

    i. Initial costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, and writing the engineering report for a total of 3.37 management hours, 6.74 administrative hours and 67.45 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings, sample analysis certification and annual review total 2.42 hours for the industrial manager, 48.31 technician hours and 4.83 administrative hours.

    ii. Monitoring costs were minimal since the primary monitoring costs involved measurement of the annual activity rate for all processes. For the industrial engineer/technician 63.2 hours were allotted for fuel sample analysis.

    iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming that 2.42 management hours, 48.32 refinery engineer/technician

hours and 4.83 administrative hours would be required to compile and store data, perform calculations, and prepare the annual report.

b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for alternate Option 2.

   i. Initial costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, and writing the engineering report for a total of 0.9 management hours, 1.9 administrative hours and 18.8 hours for the refinery engineer/technician. Quality assurance/quality control costs for planning, meetings, sample analysis certification and annual review total 1.7 management hours, 33.9 refinery engineer/technician hours and 3.4 administrative hours.

   ii. Monitoring costs were not required for this Option.

   iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming that 1.7 management hours, 33.9 refinery engineer/technician hours and 3.4 administrative hours would be required to compile and store data, perform calculations, and prepare the annual report.

c. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for alternate Option 3.

   i. Initial costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, and writing the engineering report for a total of 0.9 management hours and 18.8 hours for the refinery engineer/technician. Quality assurance/quality control costs for planning, meetings, sample analysis certification and annual review total 18.1 management hours, 362.1 refinery engineer/technician hours and 36.2 administrative hours.

   ii. Monitoring costs were not required for this Option.

   iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming that 18.1 management hours, 362.1 refinery engineer/technician hours and 36.2 administrative hours would be required to compile and store data, perform calculations, and prepare the annual report.

Assigning Costs to Cost Elements

Option 1, Selected Option

Subpart Q-Iron and Steel Industry-Combustion & Process	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager $88.79		Refinery Manager $101.31		Industrial Manager $71.03		Lawyer $101.00		Electricity Eng/ Tech $60.84		Refinery Eng/Tech $63.89		Industrial Eng/Tech $55.20		Admin $29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					3.37						67.45				6.74		$4,748.65	$0.00
QA/QC					2.42	2.42					48.31	48.31			4.83	4.83	$3,401.18	$3,401.18
Record-keeping					2.42	2.42					48.31	48.31			4.83	4.83	$3,401.18	$3,401.18
Sampling, Analysis and Calculations													63.20	63.20			$3,488.64	$3,488.64
Reporting					2.42	2.42					48.31	48.31			4.83	4.83	$3,401.18	$3,401.18
Total	0.00	0.00	0.00	0.00	10.62	7.25	0.00	0.00	0.00	0.00	212.37	144.92	63.20	63.20	21.24	14.49	$18,440.81	$13,692.17

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing			2400		$2,400	$2,400
Recordkeeping					$0	$0
Travel					$0	$0
Total			$2,400	$0	$2,400	$2,400

Option 2

Subpart Q-Option 2: Site-specific emission factor	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					0.9						18.8				1.9		$1,325.81	$0.00
QA/QC					1.7	1.7					33.9	33.9			3.4	3.4	$2,388.02	$2,388.02
Recordkeeping					1.7	1.7					33.9	33.9			3.4	3.4	$2,388.02	$2,388.02
Sampling, Analysis and Calculations																	$0.00	$0.00
Reporting					1.7	1.7					33.9	33.9			3.4	3.4	$2,388.02	$2,388.02
Total	0.00	0.00	0.00	0.00	80.19	56.35	0.00	0.00	0.00	0.00	1,614.83	1,127.08	595.20	595.20	160.38	112.71	$8,489.85	$7,164.05

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing	4,222	15	463.58	5857	$6,321	$6,321
Recordkeeping					$0	$0
Travel					$0	$0
Total	$4,222		$464	$5,857	$6,321	$6,321

Option 5

Subpart Q-Option 3: CEMS	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					0.9						18.8						$1,269.98	$0.00
QA/QC					18.1	18.1					362.1	362.1			36.2	36.2	$25,490.81	$25,490.81
Recordkeeping					18.1	18.1					362.1	362.1			36.2	36.2	$25,490.81	$25,490.81
Sampling, Analysis and Calculations															0.0	0.0	$0.00	$0.00
Reporting					18.1	18.1					362.1	362.1			36.2	36.2	$25,490.81	$25,490.81
Total	0	0	0	0	55.2	54.3	0	0	0	0	1,105.0	1,086.2	0	0	108.6	108.6	$77,742.40	$76,472.43

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing	119,120	15	13079.38		$13,079	$13,079
Recordkeeping					$0	$0
Travel					$0	$0
Total	$119,120		$13,079	$0	$13,079	$13,079

Estimation of Facility Costs for Each Threshold Level

Iron and Steel Production Source Category	Threshold Level MT CO2	Threshold Level (tpy steel)[1]	Total National Emissions[2] (metric tons of CO_2e)	Total Number of U.S. Entities[3]	Emissions Covered		Entities Covered		Total National Capital cost	Unit Cost per Entity ($/year)	Total National Cost ($/year)	Average Cost Effectiveness ($/ton CO_2e Reported)	Incremental Cost Effectiveness ($/ton CO_2e Reported)	Number of Small Businesses Reporting
					Metric Tons CO_2e/year	Percent	Number	Percent						
Method 1: Carbon balance for processes, Tiers 1, 2, 3 for fuels	144,000	400,000	85,150,877	130	84,198,514	98.9	109	84	403,790	52,888	5,764,777	0.07	0.07	TBD
	100,000	280,000	85,150,877	130	84,468,696	99.2	111	85	408,250	52,957	5,878,233	0.07	0.42	TBD
	50,000	140,000	85,150,877	130	84,739,968	99.5	114	88	414,940	52,755	6,014,064	0.07	0.50	TBD
	25,000	69,000	85,150,877	130	85,013,059	99.8	121	93	430,550	51,423	6,222,219	0.07	0.76	TBD
	10,000	28,000	85,150,877	130	85,141,423	99.99	128	98	446,160	49,969	6,396,020	0.08	1.35	TBD
	1,000	2,800	85,150,877	130	85,150,877	100	130	100	450,620	49,464	6,430,313	0.08	3.63	TBD
Method 2: Site-specific emission factor for processes, Tiers 1, 2, 3 for fuels	144,000	400,000	85,150,877	130	84,198,514	98.9	109	84	1,241,068	20,953	2,723,844	0.03	0.03	TBD
	100,000	280,000	85,150,877	130	84,468,696	99.2	111	85	1,267,674	21,371	2,778,266	0.03	0.20	TBD
	50,000	140,000	85,150,877	130	84,739,968	99.5	114	88	1,299,140	21,865	2,842,444	0.03	0.24	TBD
	25,000	69,000	85,150,877	130	85,013,059	99.8	121	93	1,345,820	22,592	2,936,909	0.03	0.35	TBD
	10,000	28,000	85,150,877	130	85,141,423	99.99	128	98	1,384,056	23,184	3,013,917	0.04	0.60	TBD
	1,000	2,800	85,150,877	130	85,150,877	100	130	100	1,397,996	23,401	3,042,154	0.04	2.99	TBD
Method 3: CEMS for processes, Tiers 1, 2, 3 for fuels	144,000	400,000	85,150,877	130	84,198,514	98.9	109	84	29,965,568	95,977	12,477,044	0.15	0.15	TBD
	100,000	280,000	85,150,877	130	84,468,696	99.2	111	85	30,681,562	98,196	12,765,543	0.15	1.07	TBD
	50,000	140,000	85,150,877	130	84,739,968	99.5	114	88	31,517,314	100,791	13,102,810	0.15	1.24	TBD
	25,000	69,000	85,150,877	130	85,013,059	99.8	121	93	32,712,974	104,518	13,587,404	0.16	1.77	TBD
	10,000	28,000	85,150,877	130	85,141,423	99.99	128	98	33,670,394	107,512	13,976,514	0.16	3.03	TBD
	1,000	2,800	85,150,877	130	85,150,877	100	130	100	34,029,028	108,629	14,121,790	0.17	15.37	TBD

12. SUBPART R—LEAD PRODUCTION

Model Facility Development

The Lead Manufacturing subpart cost analysis was conducted using a model facility which assumed that each of the 27 known facilities operate with only one process line. The selected reporting option for lead manufacturing depends on whether the facility currently uses CEMS. Facilities which already have CEMS in place should monitor GHG emissions using CEMS; otherwise, process emissions should be estimated using an input-based approach (combustion emissions are not addressed in this subpart.)

The selected option, Option 3, calculates process emissions by measuring the carbon contents and usage of the materials input to the furnace and applying the appropriate emission factors. The facility would measure the carbon content on a monthly basis.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs:

   i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours. Continued annual costs related to the monitoring plan are 4 hours for an industrial engineer/technician, 2 hours for an industrial manager, and 1 hour for a lawyer to review.

   ii. Monitoring costs (for sampling and analysis) requires 78 hours from the industrial engineer/technician and 18 hours from the administrative assistance for billing in the first year. Subsequent years require 72 hours from the industrial engineer/technician and 18 from the administrative assistance. O&M costs for monthly analysis totals $7,200. This figure is based upon monthly analysis of three product materials and testing cost of $200 per material sampled.

Assigning Costs to Cost Elements

Option 1

Table 12-1.

Subpart R—Lead Production	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													78	72	18	18	$4,839.30	$4,508.10
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	94	76	18	18	$6,391.74	$4,971.96

Table 12-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing				$7,200	$7,200	$7,200
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$7,200	$7,200	$7,200

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

13. SUBPART S—LIME MANUFACTURING

Model Facility Development

The Lime Manufacturing subpart cost analysis was conducted using a model facility and assuming that each the 89 known facilities operate with only one process line.

The selected reporting option for Lime manufacturing calculates CO_2 process emissions based on the production of each type of lime and calcined by-products/wastes produced. The measurement of production quantities is common practice in the industry so additional costs to the industry are minimal using the proposed method.

Option 2 estimates process emissions by measuring the quantity of carbonate inputs to the kiln(s) and applying the appropriate emission factors and calcination fractions to the carbonates consumed. Carbonate input compositions are quantified by sending samples of process inputs and lime kiln dust produced to an off-site laboratory for analysis on a monthly basis.

Option 3 is an input based option similar to Option 2, however, the facility would receive carbonate compositions from the supplier instead of sending samples to an off-site vendor for routine calculations. A composite sample of the carbonate input is sent to an off-site vendor once per year to verify supplier values.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs
    i. Initial costs are associated with developing the methodology and monitoring plan for calculating emissions from the production process. Planning in the first year would take an average of 8 hours from an industrial manager, 16 hours for the industrial engineer/technician and one hour for lawyer review.
    ii. Monitoring costs are for determining the carbon content of input/output materials. Options one, two, and three require sample collection by the industrial engineer/technician which averages 50, 26, and 5 hours respectively.
        1. Option 1 requires monthly samples of the product to be analyzed on-site for carbon content; the cost for supplies is estimated to be $50 per month, $600 annually.
        2. Option 2 requires samples to be sent off-site for analysis monthly which will cost an average of $200 per sample, $2400 annually.
        3. Option 3 requires off-site sampling once per year to verify carbon content reported by the suppliers; this cost is estimated to $200.

Assigning Costs to Cost elements

All Options

Table 13-1.

Subpart S—Lime Manufacturing	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations																	$0.00	$0.00
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	16	4	0	0	1552.44	463.86

Table 13-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total			$0	$0	$0	$0

Option 1

Table 13-3. Subpart S—Option One: On-site sampling; per material

	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning																	$0.00	$0.00
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													50	48			$2,760.00	$2,649.60
Reporting																	$0.00	$0.00
Total	0	0	0	0	0	0	0	0	0	0	0	0	50	48	0	0	$2,760.00	$2,649.60

Table 13-4. Option 1 Capital and O&M Costs

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$600	$600	$600
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$600	$600	$600

Option 2

Table 13-5. Subpart S—Option Two: Off-site Sampling (Monthly)

	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning																	$0.00	$0.00
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													26	24	6	6	$1,613.10	$1,502.70
Reporting																	$0.00	$0.00
Total	0	0	0	0	0	0	0	0	0	0	0	0	26	24	6	6	$1,613.10	$1,502.70

Table 13-6. Subpart S—Option Two: Off-site Sampling (Quarterly)

	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning																	$0.00	$0.00
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations																	$0.00	$0.00
Reporting							2	2					10	8			$754.00	$643.60
Total	0	0	0	0	0	0	2	2	0	0	0	0	10	8	0	0	$754.00	$643.60

Table 13-7. Option 2 Capital and O&M Costs

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$2,400	$2,400	$2,400
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$2,400	$2,400	$2,400

Option 3

Table 13-8. Subpart S—Option Three: Supplier determined carbonate values

Activity	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning																	$0.00	$0.00
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations													5	4			$276.00	$220.80
Reporting																	$0.00	$0.00
Total	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	$276.00	$220.80

Table 13-9. Option 3 Capital and O&M Costs

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$200	$200	$200
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$200	$200	$200

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

14. SUBPART T—MAGNESIUM PRODUCTION AND PROCESSING

Table 14-1. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities
1,000	13
10,000	11
25,000	11
100,000	9

Costs and measurement uncertainties for estimating greenhouse gas (GHG) emissions from magnesium production and processing facilities were estimated for emissions of SF_6, other GHG cover gases, and CO_2 carrier gas.

STEP 1: Model Facility Development

The cost estimation methodology for this sector is based on information from the 2000 Information Collection Request for EPA's SF_6 Emission Reduction Partnership for the Magnesium Industry (EPA 2000). Burden estimates were gathered from four Partners (three die casters and one die cast/remelt facility) and were averaged to represent a typical facility. Because the burden estimates in the ICR represented the costs of tracking only the cover gas, the estimated labor hours for monitoring were increased by 25% to account for tracking of CO_2, which is sometimes used as a carrier gas (the medium in which the cover gas is delivered to the melt surface). Thus the model facility for cost development purposes is a magnesium production and processing facility that incurs average costs.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into four elements, each of which was taken into consideration for this sector.

1. Regulation Compliance Determination costs.
   These costs were not separately estimated for this source category. The method and assumptions used to estimate regulation compliance determination costs across all the source categories covered by the rule is discussed in section 4.2 of the RIA.
2. Monitoring costs
   Monitoring costs are associated with data collection and tracking of cover and carrier gas usage at the facility. This effort includes determining gas total usage, estimating the average usage rate based on metal production, and tracking activities taken to

reduce emissions. Collection of gas consumption data is typically facilitated through existing cylinder weight tracking or bulk storage inventory at the facility.

3. Reporting costs
   Reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).
4. Archiving and recordkeeping costs
   Archiving and recordkeeping costs include the labor necessary to adequately archive each cycle's report and associated working documents. For archiving reports and associated working documents, the costs of a physical storage system such as a file cabinet and miscellaneous supplies are included.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

The labor and cost burden is based on a single average facility as described in Step 1, so there was no need to proportion facilities into different model facility levels.

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►Determining Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For this analysis, four labor categories were used as shown in Table 14-2.

Table 14-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Legal	Oversees legal aspects of company reports and data-reporting forms.	$101.00/hour
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs gas chromatography measurements	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

►***Allocating Responsibilities***

As noted above, labor hours for all cost elements were assigned based on the 2000 Information Collection Request for EPA's SF_6 Emission Reduction Partnership for the Magnesium Industry (EPA 2000), and expert judgment. Hours assigned are based on an average facility using burden information as described in Step 1. Table 14-3 summarizes these roles.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are other costs for archiving and recordkeeping.

►***Other Costs***

Magnesium production and processing facilities were assumed to incur other costs related to archiving and recordkeeping of information. These costs consist of purchases of miscellaneous supplies and information storage. Startup costs are estimated to be $117 for miscellaneous supplies and are reported in 2006 U.S. dollars using an annualization assumed over an equipment life of 3 years with a 7% interest rate. From these factors, a capital recovery factor of 31% was calculated resulting in an annualized cost of $36. Annual other costs are estimated to be $105 for file storage, recordkeeping, and postage, and $12 for upkeep of supplies. The total for annualized other costs is $153.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs per facility are constant at each threshold level because reporting costs are estimated to be identical for all facilities. Total costs per facility were calculated by multiplying that labor costs times the labor hours, and adding in the other costs for each facility.

Table 14-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities and Hours by Labor Category								Per Facility/ per Company
	Legal		Managerial		Technical		Clerical		
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Monitoring									
Collection of cylinder tracking or bulk storage data			Review the collection plan	5	Develop a collection plan	27.5			Per facility
Reporting									
Compile data, enter into reporting system, and submit report	Review the reporting documentation	2	Review the reporting documentation and submit report	2	Prepare reporting documentation	6			Per facility
Archiving and Recordkeeping									
Archiving reports							Archive the reporting documentation	4	Per facility

15. SUBPART V—NITRIC ACID PRODUCTION

Model facility development

For the Nitric Acid Production subpart, one model facility was developed using a facility-level inventory for 2006, which represented the known universe of 45 separate nitric acid production facilities with a total of 65 process lines. The model facility used for the cost analysis has an average of 1.44 process lines/process stacks per facility. All testing required for Option 3 and Option 5 was assumed to be done on each process stack.

The selected Option, Option 3 uses periodic direct monitoring of N_2O emissions from each process stack to develop a site-specific emissions factor based on nitric acid production levels.

Option 5 uses CEMS to directly measure N_2O concentration and flow rate to directly determine N_2O emissions; these costs were calculated using the CEMS Cost Model, assuming that an N_2O analyzer is similar in cost to a CO_2 analyzer and that the facility does not have existing CEMS equipment. The facility-level inventory does not indicate that any adipic acid production facilities have existing CEMS.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3
    i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours.
    ii. Monitoring costs (for sampling and analysis) were estimated for conducting the annual stack test. On average, it would take 34.5 hours for an industrial engineer/technician and 26.5 hours for an industrial manager to conduct each stack test. Each model plant contains 1.44 process stacks for a total of 88.1 hours per facility. The O&M costs total $2,400 for equipment and $160 for travel per stack for a total of approximately $3,700 per facility.
    iii. Reporting costs were estimated on an annual basis, assuming that an industrial engineer/technician, industrial manager, and administrative staff would each need an average of 8 hours per year per stack to prepare the annual report for a total of 34.7 hours. It was assumed that recordkeeping costs would total $50 per stack for a total of $72 per facility.
b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 5—no existing CEMS (40% of facilities).

i. Initial planning costs were estimated for the time needed to review the rule, prepare required initial notifications and records, resolve questions, review drawings, conduct source inspections, and define constraints was 39 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings and annual review total 27 engineer/technical hours in the first year and 46 hours in subsequent years. Operation and maintenance costs were estimated assuming $364 for resolving questions and inspecting the source; $650 for selecting the equipment; $17,600 for support needed to prepare for installation of the CEMS equipment, including platforms, ladders, utilities, etc.; $66,663 for purchasing the CEMS equipment, $7,940 to install and check the CEMS equipment; and $75 for performance specification testing for a total of $93,292, annualized to $10,244.

ii. Monitoring costs (for sampling and analysis), including selecting equipment, installing/checking the CEMS, and the performance specification test accounts for 246 engineer/technical hours in the first year and 174 hours in the subsequent years. The O&M costs total $75 for performance testing per facility.

iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 24 engineer/technical hours in the first year and 4 hours in subsequent years.

c. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 5—existing CEMS (60% of facilities).

i. Initial planning costs were estimated for the time needed to review the rule, prepare required initial notifications and records, resolve questions, review drawings, conduct source inspections, and define constraints was 15 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings and annual review total 18 engineer/technical hours in the first year and 20 hours in subsequent years. Operation and maintenance costs were estimated assuming $355 for selecting the equipment; $8,368 for purchasing the CEMS equipment; and $690 for training on the CEMS equipment for a total of $9,408, annualized to $1,033.

ii. Monitoring costs (for sampling and analysis), including selecting equipment, installing/checking the CEMS, and the performance specification test accounts for 87 engineer/technical hours in the first year and 36 hours in the subsequent years. The O&M costs total $2,533 for performance testing per facility.

iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 5 engineer/technical hours in the first year and 4 hours in subsequent years. The O&M costs total $50 for recordkeeping per facility.

d. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 5—total.

   i. Initial planning costs were estimated for the time needed to review the rule, prepare required initial notifications and records, resolve questions, review drawings, conduct source inspections, and define constraints was 24.6 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings and annual review total 21.6 engineer/technical hours in the first year and 30.4 hours in subsequent years. Operation and maintenance costs were estimated assuming $42,932 for resolving questions and inspecting the source; for selecting the equipment; for support needed to prepare for installation of the CEMS equipment, including platforms, ladders, utilities, etc.; for purchasing the CEMS equipment; and for installing and checking the CEMS equipment, annualized to $4,714.

   ii. Monitoring costs (for sampling and analysis), including selecting equipment, installing/checking the CEMS, and the performance specification test accounts for 87 engineer/technical hours in the first year and 36 hours in the subsequent years. The O&M costs total $1,550 for performance testing per facility.

   iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 5 engineer/technical hours in the first year and 4 hours in subsequent years. The O&M costs total $30 for recordkeeping per facility.

Assigning Costs to Cost Elements

Table 15-1a. Option 3 Labor Costs

	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations					38.3	38.2							49.8	49.8			$5,468.82	$5,460.46
Reporting					11.6	11.6							11.6	11.6	11.6	11.6	$1,800.73	$1,800.73
Total	0	0	0	0	57.8	51.7	1	1	0	0	0	0	77.4	65.4	11.6	11.6	$8,821.99	$7,725.04

Table 15-1b. Option 3 Capital and O&M Costs

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$0	$0	$0
Performance testing				$3,466	$3,466	$3,466
Recordkeeping				$72.20	$72	$72
Travel				$231.04	$231	$231
Total			$0	$3,769	$3,769	$3,769

Option 5—no existing CEMS (40% of facilities)

Table 15-2a. Option 5 Labor Costs for facilities with no existing CEMS

Subpart V—Nitric Acid Production Option 3	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													39	0			$ 2,153	$0
QA/QC													27	46			$ 1,500	$2,539
Recordkeeping													0	18			$0	$994
Sampling, Analysis and Calculations													246	174			$13,586	$9,604
Reporting													24	4			$1,325	$221
Total	0	0	0	0			0	0	0	0	0	0	336	242	0	0	$18,564	$13,357

Table 15-2b. Option 5 Capital and O&M Costs for facilities with no existing CEMS

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$93,217	$93,217	$1,000
Performance testing				$75	$75	$2,499
Recordkeeping				$0	$0	$50
Travel				$0	$0	$0
Total			$0	$93,942	$93,942	$3,549

Option 5—existing CEMS (60% of facilities)

Table 15-3a. Option 5 Labor Costs for facilities with existing CEMS

Subpart V—Nitric Acid Production Option 3	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													15	0			$828	$0
QA/QC													18	20			$1,000	$1,104
Recordkeeping													0	12			$0	$662
Sampling, Analysis and Calculations													87	36			$4,817	$1,959
Reporting													5	4			$276	$221
Total	0	0	0	0	0	0	0	0	0	0	0	0	125	72	0	0	$6,921	$3,947

Table 15-3b. Option 5 Capital and O&M Costs for facilities with existing CEMS

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$ /year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$9,408	$9,408	$0
Performance testing				$2,533	$0	$2,533
Recordkeeping				$50	$0	$50
Travel				$0	$0	$0
Total			$0	$11,991	$9,408	$2,583

Option 5—Total

Table 15-4a. Option 5 Labor Costs—Total

Subpart V—Nitric Acid Production Option 3	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													24.6	0			$1,358	$0
QA/QC													21.6	30.4			$1,200	$1,678
Recordkeeping													0	14.4			$0	$795
Sampling, Analysis and Calculations													150.6	91.2			$8,325	$5,017
Reporting													12.6	4			$696	$221
Total	0	0	0	0	0	0	0	0	0	0	0	0	209.4	140	0	0	$11,578	$7,711

Table 15-4b. Option 5 Capital and O&M Costs—Total

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$42,932	$42,932	$400
Performance testing				$1,550	$30	$2,519
Recordkeeping				$30	$30	$30
Travel				0	0	0
Total			$0	$44,771	$43,222	$2,969

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis. Table 15-5 shows the number of representative affected entities under each threshold.

Table 15-5. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities
1,000	3
10,000	3
25,000	3
100,000	3

16. SUBPART W—OIL AND NATURAL GAS SYSTEMS

Example of Summary Text Description: Fugitive Emissions

NOTE: In this subpart, three representative entities were developed and the same three were used across each threshold. Because of similarities in the cost analysis, the text discussion covers all three in the description.

However, other subparts may have cost methodologies that differ significantly. In these cases, it may be necessary to repeat the structure below *for each representative entity*.

STEP 1: Model Facility Development

For each of the industry segments, operations had to be divided into single units or model facilities at three levels; "small," "medium," and "large." The monitoring costs were then developed per size level of a model facility. A model facility of a given level (small, medium, large) can be defined as the most convenient and logical unit with appropriate emissions source counts that can aggregate to any size company to determine its monitoring costs. For example, in onshore natural gas transmission, a compressor station as a facility was modeled at the different levels. Any transmission company can determine its monitoring costs by assigning model facility costs to its facilities that are closest to the appropriate level of the model facility.

For each of the sources designated for monitoring, both equipment and component counts were determined to define individual model facilities. For onshore natural gas processing, onshore natural gas transmission, underground natural gas storage, and LNG storage and import facilities, emissions source counts for medium facilities were assigned the national average activity factors from the National Inventory. The related uncertainty in those activity factors were used to determine the lower bound on emissions source counts, and assigned to a "small" facility. Similarly, the upper bound on emissions source counts was assigned to a "large" facility. In the case of offshore petroleum and natural gas production, MMS GOADS-2000 data analysis by EPA was used in the same fashion as the national inventories. In some cases, the uncertainty estimates were not applicable. For example, if the uncertainty is over 100%, it would predict a negative lower bound for emissions source counts. For these cases, expert judgment was used. Expert judgment was also used, where necessary, to adjust emissions source counts to reflect real world scenarios.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered

in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost associated with initiating the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs.

1. Regulation compliance determination costs
    a. Start-up costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out any appropriate forms.
    b. Recurring costs will be small and consist entirely of labor expenses. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought into operation or taken offline.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs. Capital investment will be required for purchasing monitoring equipment. This capital cost will be accounted as annualized cost, on an annual basis. Labor will be required for product research for monitoring instruments before actual purchase. Before actual monitoring takes place, labor will have to be devoted to the development of a monitoring plan that will be used company-wide. Finally, selected employees will be trained on how to use the monitoring equipment.
    b. Recurring monitoring costs consist of labor, travel, and shipping of equipment. Each cycle, labor will be required to conduct detection and measurement of emissions, i.e., perform actual monitoring of emissions. For companies with multiple facilities, travel may be required for the monitoring team and/or the monitoring instruments may require shipping to multiple locations.
3. Reporting costs
    a. There will be no start-up reporting costs; reporting costs are applied uniformly across source categories reporting to the rule.
    b. Recurring reporting costs consist of labor necessary to document collected emissions data from fugitive emissions monitoring and to submit the official report in each cycle (i.e., annually).
4. Archiving and recordkeeping costs
    a. Start-up archiving and recordkeeping costs consist of labor and annualized capital purchase of storage space. For archiving reports and associated working documents, physical storage system such as a file cabinet, and electronic storage system such as an external hard drive, will be required.
    b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.
5. Auditing costs
    a. There is no start-up cost associated with auditing.

b. Recurring auditing costs consists of labor required to validate to the EPA results from the monitoring of emissions and the follow-up of rectifying any weaknesses found through the audit. The EPA audit is assumed to occur once in several years, not on an annual basis.

STEP 3: Analyze Proportion of Facilities in Different Model Facility Levels

To classify the facilities into different sizes, total combustion and fugitive CO_2, N_2O, and CH_4 emissions from individual facilities, expressed in CO_2e, were rank listed in an ascending order. Cumulative fugitive emissions for the facilities were calculated. The cumulative emissions, in combination with the total emissions from all facilities, were used to assign facilities to the small, medium, and large category.

$$Percentile(\%) = \left(\frac{CumulativeEmissions}{TotalEmissions} \right)$$

The facilities that accounted for the first 33% of the emissions nationally in the ranked list were identified as a small facility. The facilities that accounted for national emissions greater than 33% but less than 67% in the ranked list were identified as a medium facility. The facilities that accounted for national emissions over 67% in the ranked list were identified as a large facility. Table 1 indicates the source for the gas emissions, and the number of facilities that fall into each category per segment.

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates,
2. Allocate responsibilities to labor categories to estimate labor hours, and
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements.

These steps are described in further detail below.

Table 16-1. Allocation of Facilities to Model Types

Segment	Data Source	Small Facilities	Medium Facilities	Large Facilities
Offshore Petroleum and Natural Gas Production				
Facility Percentile	MMS GOADS Report	0–33%	33%–67%	67%–100%
Facility Count	MMS GOADS Report	2,416	108	2
*Operator/Company**	Not estimated			
Onshore Natural Gas Processing				
Facility Percentile	API Processing Report	0–33%	33%–67%	67%–100%

*Facility Count**	API Processing Report	409	67	15
Operator/Company	API Processing Report	165	29	10
Onshore Natural Gas Transmission				
Facility Percentile	FERC	0–33%	33%–67%	67%–100%
Facility Count	FERC	1,329	370	245
Operator/Company	FERC	142	45	26
Natural Gas Underground Storage				
Facility Percentile	EIA	0–33%	33%–67%	67%–100%
Facility Count	EIA	324	51	22
Operator/Company	EIA	98	38	17
LNG Storage				
Facility Percentile	GTI	0–33%	33%–67%	67%–100%
Facility Count	GTI	140	12	4
Operator/Company	GTI	140	12	4
LNG Import				
Facility Percentile	FERC	—	0–100%	—
Facility Count	FERC	—	5	—
Operator/Company	Not estimated			

* MMS 2007 statistics reports 3,923 offshore platforms and 139 operators. No data are available for individual offshore platforms and their respective operators.

►*Determining Labor Categories*

To evaluate labor costs, it was necessary to not only determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, four labor categories were used, as shown in Table 16-2.A.

Table 16-2.A. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Senior Manager	Oversees work at a high level. Is the final authority on all reporting requirements.	$101.31/hour
Middle Manager	Oversees Junior Engineer's progress and reports; also interacts with Senior Manager. Does not gather information, write reports, or perform monitoring.	$88.79/hour
Junior Engineer	Conducts monitoring of emissions sources. Interfaces between Middle Manager and Senior Operator to collect information and complete reports.	$71.03/hour
Senior Operator	Primarily interfaces with Junior Engineer to collect facility information and assist with initiating the reporting process and reporting. Sometimes logs data used in the monitoring process.	$63.89/hour

These labor rates originate from an analysis of loaded hourly rates for goods and producing private establishments at the end of 2007, shown in Table 16-2.B below. Since the oil and gas industry pays comparatively high to other industries, the top four non-lawyer categories were used to be conservative in this approximation. Specifically, the labor rate of senior managers were assumed to be that of refinery mangers, middle manager labor rates were assumed to be that of electricity managers, junior engineer labor rates were assumed to be that of industrial managers, and senior operator labor rates were assumed to be that of refinery engineers/technicians.

Table 16-2.B. Loaded Hourly Rates for Goods Producing Private Establishments

Labor Category	Loaded Hourly Rate ($/hour)
Electricity Manager	$88.79
Refinery Manager	$101.31
Industrial Manager	$71.03
Lawyer	$101.00
Electricity Engineer/Technician	$60.84
Refinery Engineer/Technician	$63.89
Industrial Engineer/Technician	$55.20
Administrative Support	$29.65

►***Allocating Responsibilities***

Assigning labor hours for all cost elements was based on expert judgment. When assigning hours, the size of the facility and role of the labor categories were taken into consideration. Table 16-3 summarizes these roles:

Table 16-3. Responsibilities for Regulation Compliance by Labor Category

	Responsibilities by Labor Category				
Cost Element	**Senior Management**	**Middle Management**	**Junior Engineer**	**Senior Operator**	**Per Facility/ Per Company***
Regulation Compliance Determination Costs					
Facility data	To review reporting documentation/systems and facility data	To review reporting documentation/ systems and facility data	To initiate reporting process and prepare facility data	To prepare and review reporting process documentation and facility data	Per facility
Regulation review	To review the new regulations	To review the new regulations	To examine and identify potential new regulations	To review the new regulations identified and determine their applicability	Per company
Monitoring					
Plan development	To review the monitoring plan	To review the monitoring plan	To develop a monitoring plan	To develop and review the monitoring plan	Per company

Equipment purchase	To approve the equipment purchase	To review the equipment to be purchased	To identify and purchase the equipment	To review the equipment to be purchased	Per company
Start-up/ training		To review training plan	To acquire training	To provide and acquire training	Per facility
Reporting					
Data documentation	To review the reporting documentation	To prepare and complete the reporting documentation	To prepare reporting documentation	To prepare and complete reporting documentation	Per facility
Report submission		To ensure the completion of the reporting documentation	To submit the report		Per Facility
Archiving and Recordkeeping					
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per facility
Auditing					
Audit	To review the audit results	To review the audit results	To assist and provide information on EPA audits		Per facility
Audit follow-up	To review the audit follow-up results and approve corrective measures	To review the audit follow-up results and review corrective measures	To determine corrective measures from EPA audit	To assist in determining corrective measures from EPA audit	Per facility

* Some activities only have to be done at the company level, with information and/or equipment shared among facilities of the company.

The labor costs associated with performing the actual annual monitoring were omitted from the table above. For these costs it was assumed that all labor will be performed by middle managers, junior engineers, and senior operators. Middle managers will spend a total of 2 hours overseeing the monitoring process per quarter, but will not perform any of the monitoring. It was assumed that junior engineers will do all monitoring, except in cases where senior operators will log any activity data required to estimate emissions over the course of the quarter. Several pieces of equipment are common among different onshore segments and different facility sizes, but the actual monitoring time will not change per equipment unit. For example, reciprocating compressors are found in all onshore segments for facilities of almost all sizes. Screening a single reciprocating compressor for leaks was assumed to take 2 hours onshore, and that will not change by segment or facility size; what changes is the number of reciprocating compressors. Thus, a series of universal assumptions about onshore monitoring times were created. These were multiplied by the emissions source counts assigned to each of the model facilities to determine the required labor hours. Table 16-4 summarizes the rules in allocating hours for conducting fugitive emissions monitoring.

Table 16-4. Responsibilities for Onshore Monitoring and Allocation of Labor Hours

Element	Onshore Responsibilities by Labor Category and Hours per Responsibility		
	Detection	**Measurement**	**Applicable Segments**
Facility/Station Fugitive emissions			
Junior engineer	Conduct fugitive emissions detection survey (8 hours/ facility)	Measure identified fugitive emissions (16 hours/facility)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Senior operator	Oversee part of the detection process and review results (2 hours/reporting period)	Oversee part of the measurement process and review results (4 hours/ reporting period)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Reciprocating Compressors			
Junior engineer	Check unit for fugitive emissions (2 hours/ compressor)	Measure identified fugitive emissions (2.5 hours/ compressor)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Centrifugal Compressor Fugitive Emissions			
Junior engineer	Check unit for fugitive emissions (2 hours/ compressor)	Measure identified fugitive emissions (2.5 hours/ compressor)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Natural Gas Engines			
Junior engineer	View and log engine meter reading (15 minutes/engine)	Perform emissions calculation (5 minutes/engine)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Natural Gas Turbines			
Junior engineer	View and log fuel meter reading (30 minutes/turbine)	Perform emissions calculation (10 minutes/ turbine)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Acid Gas Removal Vent Stacks			
Junior engineer			Processing
Senior operator	Review log book for number of actuations (30 minutes/ AGR Vent)	Perform simulation runs (10 minutes/AGR Vent)	
Kimray Pumps			
Junior engineer	Obtain manufacturer data for engineering calculations (15 minutes/pump)	Perform emissions calculation (5 minutes/ pump)	Processing, Transmission, Storage
Dehydrator Vent Stacks			
Junior engineer	Collect data for simulation software (30 minutes/ dehydrator vent)	Perform simulation runs (10 minutes/dehydrator vent)	Processing, Transmission, Storage
Wellhead Fugitive Emissions			
Junior engineer	Check wellheads for fugitive emissions (15 minutes/well)	Measure identified fugitive emissions (15 minutes/well)	Storage
Natural Gas Driven Pneumatic Manual Valve Actuator Devices			
Junior engineer	Review log book for number	Perform emissions	Processing, Transmission,

	of actuations (15 minutes/ manual actuation)	calculation (5 minutes/ pneumatic device)	Storage
Senior operator	Log manual actuations (5 minutes/manual actuation)		
Natural Gas Driven Pneumatic Valve Bleed Devices			
Junior engineer	Check devices to assure active use (1 minute/pneumatic device)	Calculate bleed rates based on use and design (30 minutes/pneumatic device)	Processing, Transmission, Storage
Blowdown Vent Stacks			
Junior engineer	Review log book for number of events (15 minutes/quarter)	Perform emissions calculation (5 minutes/ calculation)	Processing, Transmission, Storage, LNG Storage, LNG Import Facilities
Senior operator	Log blowdowns (15 minutes/ quarter)	—	

Table 16-4 does not include equipment monitoring on offshore petroleum and natural gas production facilities. The assumptions for assigning labor times for monitoring offshore emissions sources are summarized in Table 16-5.

Table 16-5. Responsibilities for Offshore Monitoring and Allocation of Labor Hours

Cost Element	Offshore Responsibilities by Labor Category and Hours per Responsibility	
	Detection	**Quantification**
Offshore Oil and Natural Gas Production Facility Fugitive Emissions		
Junior engineer	Conduct fugitive emissions detection survey (8 hours/facility)	Measure identified fugitive emissions (8 hours/facility)
Middle management	Oversee part of the detection process and review results (2 hours/reporting period)	Oversee part of the measurement process and review results (2 hours/reporting period)
Compressor Fugitive Emissions		
Junior engineer	Check unit for fugitive emissions (0.01 hours/compressor)	Measure identified fugitive emissions (0.5hours/dry seal and 1hr/wet seal)
Reciprocating Compressor Rod Packing		
Junior engineer	Check unit for fugitive emissions (0.1 hours/compressor)	Measure identified fugitive emissions (1 hour/compressor)
Other Fugitive Emissions		
Junior engineer	Check unit for fugitive emissions (0.01 hours/other fugitives)	Measure identified fugitive emissions (0.25 hours/fugitives) assuming that 10% of population is identified
Connectors		
Junior engineer	Check for fugitive emissions (0.01 hours/connector)	Measure identified fugitive emissions (0.25 hours/connector) assuming that 1% of population is identified
Flanges		

Junior engineer	Check for fugitive emissions (0.01 hours/flange)	Measure identified fugitive emissions (0.25 hours/flange) assuming that 1% of population is identified
Open-ended Lines (OELs)		
Junior engineer	Check for fugitive emissions (0.01 hours/OEL)	Measure identified fugitive emissions assuming 10% OELs are small and emitting (0.25 hours /OEL); Assuming 5% of all OELs are large and emitting (1 hour/OEL)
Other Relief Valves		
Junior engineer	Check for fugitive emissions (0.01 hours/PRV*)	Measure identified fugitive emissions (0.5 hours/PRV) assuming that 10% of population is identified

(continued)

Table 16-5. Responsibilities for Offshore Monitoring and Allocation of Labor Hours (continued)

Cost Element	Offshore Responsibilities by Labor Category and Hours per Responsibility	
	Detection	**Quantification**
Non-pneumatic Pumps		
Junior engineer	Check unit for fugitive emissions (0.01 hours/pump)	Measure identified fugitive emissions (1 hour/pump) assuming that 10% of population is identified
Valves		
Junior engineer	Check for fugitive emissions (0.01 hours/ valve)	Measure identified fugitive emissions (0.25 hours/pump) assuming that 10% of population is identified
Acid Gas Removal Vent Stacks		
Junior engineer	Collect data for simulation software (0.1 hours/AGR Vent)	Perform simulation runs (0.5 hours/ calculation)
Boiler/Heater/Burner		
Junior engineer	Check unit for fugitive emissions (0.25 hours/platform)	Measure identified fugitive emissions (0.25 hours/platform)
Diesel or Gasoline Engine		
Junior engineer	Check unit for fugitive emissions (0.25 hours/platform)	Measure identified fugitive emissions (0.25 hours/platform)
Drilling Rig		
Junior engineer	Check unit for fugitive emissions (0.25 hours/platform)	Measure identified fugitive emissions (0.25 hours/platform)
Flare Stacks		
Junior engineer	Collect material balance data (0.5 hours/ flare)	Perform calculations (0.5 hours/ calculation)
Dehydrator Vent Stacks		
Junior engineer	Collect data for simulation software (0.5	Perform simulation runs (0.5 hours/

	hours/unit)	calculation)
Loading Operation		
Junior engineer	Collect data for calculations (0.25 hours/ calculation)	Perform emissions calculations (0.25 hours/calculation)
Losses from Flashing		
Junior engineer	Check unit for fugitive emissions (0.01 hours/vent)	Measure identified fugitive emissions (0.5 hours/vent)
Mud Degassing		
Junior engineer	Collect data for calculations (0.25 hours/ calculation)	Perform emissions calculations (0.25 hours/calculation)
Natural Gas Engines		
Junior engineer	View and log engine meter reading (0.25 hours/platform)	Perform emissions calculation (0.25 hours/platform)

(continued)

Table 16-5. Responsibilities for Offshore Monitoring and Allocation of Labor Hours (continued)

Cost Element	Offshore Responsibilities by Labor Category and Hours per Responsibility	
	Detection	**Quantification**
Natural Gas Driven Pneumatic Pumps		
Junior engineer	Obtain manufacturer data for engineering calculations (0.01 hours/pump)	Measure identified fugitive emissions (0.25 hours/pump) assuming that 10% of population is identified
Natural Gas Driven Pneumatic Valve Bleed Devices		
Junior engineer	Check controllers for fugitive emissions (0.01 hours/unit)	Measure identified fugitive emissions (0.25 hours/unit) assuming that 10% of population is identified
Storage Tanks		
Junior engineer	Check tanks for fugitive emissions (0.01 hours/unit)	Measure identified fugitive emissions (1 hour/unit)
Vent Stacks		
Junior engineer	Collect data for calculations (0.25 hours/vent)	Perform emissions calculation (0.25 hours/vent)

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are due to the annualized capital costs and travel, lodging, and shipping to conduct the actual emissions monitoring.

►***Capital Cost Annualization and O&M Costs***

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection, emissions measurement, and information storage. All costs are reported in 2006 U.S. dollars and annualization was assumed over an equipment life of 5 years with a 7% interest rate. From these factors, a capital recovery factor of 24% was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 16-6 below summarizes the capital costs associated with the monitoring program. Additionally, the table describes the annual costs of travel, lodging, and shipping—the only other non-labor costs related to the monitoring program.

Table 16-6. Monitoring Program Compliance Capital Costs and Other O&M

Element	Capital Cost	Annualized Capital Cost
Archiving		
Capital costs	Cost of archiving material per facility assumes cost of 1 file cabinet, 4-drawer vertical from Office Depot™ ($140), and 1 hard drive for data storage from Seagate™ ($95)	$57
Monitoring		
Equipment purchase	Screening equipment for larger operations or many facilities was assumed to be $100,000 for IR Camera and miscellaneous components	$24,389
	Screening equipment for smaller operations was assumed to be $10,000 for a TVA or OVA and miscellaneous components.	$7,317
Measurement		
Equipment purchase	Measurement equipment assumes cost for High Volume Sampler and miscellaneous components ($30,000)	$7,317
Traveling	Cost of traveling for an engineer to a facility from the home facility (therefore n-1 facilities to visit). Assuming travel cost is $0.485/mile, $150/night for overnight stay, and $100/shipment for shipping equipment. For offshore platforms the cost of traveling for a junior engineer and for transporting the equipment via boat or helicopter was assumed to be $100/facility. This assumes that the facilities are visited on an ongoing basis for routine business and incremental cost is in carrying the additional instruments for monitoring.	$0–$4,616*

* Annual travel costs are highly variable depending on the facility type, proximity, and ownership structure. Annual travel costs are estimated to vary from $0 to $4,616.

As shown in Table 16-6, the fugitive emissions detection methods vary depending on the size of the company and its facilities. In the case of companies with small operations and few facilities, it will not be necessary to purchase an IR camera for fugitive emissions detection. The advantage of an IR camera is that it can scan hundreds of components per hour. For companies with larger operations and many facilities, this will be advantageous because of the time constraints of surveying the equipment and numerous equipment components. However, a small company can use TVAs or OVAs or laser based IR technologies to conduct emissions detection.

Table 16-7 summarizes the assumed equipment purchases necessary per "small," "medium," and "large" facility for each segment.

With the equipment costs per company determined, the final step was to divide company capital and O&M costs amongst individual facilities owned by a typical company.

Table 16-7. Equipment Purchase Requirements by Segment and Model Facility Size

Segment	"Small" Facility	"Medium" Facility	"Large" Facility
Offshore Oil and Natural Gas Production	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler
Onshore Natural Gas Processing	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler
Natural Gas Transmission	1 OVA/TVA 1 high volume sampler	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler
Underground Natural Gas Storage	1 OVA/TVA 1 high volume sampler	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler
LNG Storage	1 OVA/TVA 1 high volume sampler	1 IR detection instrument 1 high volume sampler	1 IR detection instrument 1 high volume sampler
LNG Import Facilities	—	1 IR detection instrument 1 high volume sampler	—

Step 3 above provided the proportion of facilities that fall in the small, medium, and large categories. By determining the companies that fall in the three categories, the average number of "small," "medium," and "large" facilities per company was determined. To convert the annualized capital costs and equipment purchases, the costs per equipment were multiplied by the purchased equipment counts per company, and then divided by the number of facilities per company in each category, as shown in the equation below:

$$\frac{\$AnnualCapital}{Facility} = \left(\frac{\$AnnualCapital}{Equipment} \times \frac{\#ofEquipment}{Company} \right) \div \left(\frac{Facilities}{Company} \right)$$

The travel, lodging, and shipping costs associated with monitoring several facilities spread over large regions were calculated using the assumed costs in Table 16-6. Expert judgment based on the number of teams using equipment and the necessity of travel versus shipping between facilities was used to determine these costs.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs across each segment were determined by assigning model facility costs (small, medium, and large) to individual facilities in the industry based on relative size and determining total costs from the entire segment. This was done for only those facilities that exceeded the reporting threshold. Average cost per facility was then determined by dividing the total segment costs by the number of all facilities that exceeded the reporting threshold—small, medium, or large.

17. SUBPART X—PETROCHEMICAL PRODUCTION

Model facility development

For the Petrochemical Manufacturing subpart, model facilities were not developed due to insufficient data for differentiating costs for compiling data and conducting sampling across different facilities. Facilities using Option 1 could estimate CO_2 and CH_4 emissions using default emission factors (e.g., the factors suggested by the IPCC), but facilities using Option 2 and 3 would have to evaluate each type of process independently.

Option 1 assumes the use of a default emission factor based on the type of process and an annual activity rate.

Option 2 assumes the use of a carbon balance using all feedstocks and products/byproducts to estimate emissions containing CO_2 derived from the feedstocks, and measurement of flow and carbon content of supplemental fuel used in combustion devices that supply energy to a petrochemical process.

Option 3 requires facilities to perform direct and continuous measurement of CO_2 emissions from each stack (process vent or combustion source, except flares) using a continuous emission monitoring system for CO_2 concentration and stack gas volumetric flow rate.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 2, the selected option.

    i. Initial costs were estimated for the time needed to review the rule and prepare required initial notifications and records. These planning hours include resolving questions, reviewing drawings, conducting source inspections, defining constraints, and writing the engineering report for a total of 5 management hours and 43.8 hours for the industrial engineer/technician. Quality assurance/quality control costs for planning, meetings and annual review total 127 engineer/technical hours.

    ii. Monitoring costs (for sampling and analysis) were considered minimal because it was assumed that all petrochemical facilities are already measuring the flows and composition of the feedstocks and products. Twelve industrial engineer/technician hours were allotted for fuel sample analysis. When necessary (such as in Option 1) supplemental fuel costs were based on algorithms for the stationary fuel combustion source category.

iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming that an engineer would need, on average, 12 engineer/technician hours per year to compile and store data, perform calculations, and prepare the annual report.

b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 1.

   i. Initial costs were estimated for the time needed to review the rule and prepare required initial notifications and records, assuming that on average, it would take a technical engineer one hour to review the applicable parts of the rule and 0.5 hours to prepare the initial records. Additional planning included calculation of emissions based on default emission factors and collection of facility production rates for a total of 13.5 hours for the industrial engineer/technician.

   ii. Monitoring costs (for sampling and analysis) were not included since it was assumed that all petrochemical facilities have already measured the flows and composition of the products.

   iii. Recordkeeping and reporting costs were not estimated because it was assumed that the petrochemical production rate is already available in company records because this information is needed for financial purposes.

c. Costs for Option 3 included the monitoring costs from Option 2, but also included Continuous Emissions Monitoring (CEMS) on each process vent and combustion source stack. In addition, this option would require the petrochemical facility owner to use engineering analyses to estimate flow and carbon content of gases discharged to flares. A third part of this option is that methane emissions from wastewater systems would have to be estimated and reported. Due to the high cost of this option, it was not selected and is not represented here.

Assigning Costs to Cost Elements

Option 2

Petrochemical - Option 2	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			5										43.8				$2,924.31	$0.00
QA/QC													127.08	74.28			$7,014.82	$4,100.26
Recordkeeping													58.8	58.8			$3,245.76	$3,245.76
Sampling, Analysis and Calculations													12	12			$662.40	$662.40
Reporting			6.6	6.6													$668.65	$668.65
Total	0	0	11.6	6.6	0	0	0	0	0	0	0	0	241.68	145.08	0	0	$14,516	$8,677

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				$1,800	$1,800	$1,800
Performance testing				$1,984	$1,984	$1,984
Recordkeeping				$100	$100	$100
Travel					$0	$0
Total	$0		$0	$3,884	$3,884	$3,884

Option 1

Petrochemical Option 1	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning											13.5	12					$862.52	$766.68
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations																	$0.00	$0.00
Reporting																	$0.00	$0.00
Total	0	0	0	0	0	0	0	0	0	0	13.5	12	0	0	0	0	$863	$767

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$ /year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)					$0	$0
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$0	$0	$0

18. SUBPART Y—PETROLEUM REFINERIES

Model facility development

For the Petroleum Refinery subpart, costs were developed on a model emission source basis. Specifically, costs were developed based on 150 petroleum refineries (including asphalt plants) using the following assumptions:

- Process heaters and boilers
  - an average refinery was assumed to have 2 fuel gas systems servicing 12 process heaters or boilers
  - 90 percent of fuel gas systems were assumed to have CEMS to monitor flow rate and heating value content
  - 20 percent of process heaters and boilers were assumed to have CEMS on the individual process heater or boiler exhaust stack
  - special evaluation was made for 3 boilers that were solid-fuel fired and have a capacity exceeding 250 MMBtu/hr
- Flares
  - an average refinery was assumed to have 3 flares
  - 20 percent of flares have CEMS to monitor flow rate and heating value content (or total organic carbon)
- Fluid catalytic cracking units and fluid coking units (FCCU/FCU)
  - total of 125 units nationwide based on process-specific counts
  - 90 percent of FCCU/FCU have CO_2 CEMS to monitor coke-burn rate
  - 40 percent of FCCU/FCU have CEMS that monitor final stack CO_2
- Sulfur recovery plants
  - total of 195 process trains nationwide based on process-specific counts
  - 10 percent of sulfur recovery plants have CEMS to monitor inlet sour gas flow and composition
  - 5 percent of sulfur recovery plants have CEMS that monitor final stack CO_2
- Hydrogen plants
  - total of 54 units nationwide based on process-specific counts
  - 10 percent of FCCU/FCU have CEMS that monitor stack CO_2
- Other fugitive sources (equipment leaks, storage vessels, etc.)
  - treated as one general source per refinery
  - 50 percent already perform the more detailed estimation methods (use Method 21 for equipment leaks, TANKS model for storage vessels, etc.)

Three general options were evaluated. Option 1 is the use of engineering assessment for all emission sources except the FCCU/FCU coke burn-off vent. Option 2 is the use of measurement methods for the largest emission sources and engineering assessments for the smaller emission sources. Option 3 is the use of measurement methods or detailed fugitive calculations for all emission sources.

For all options, costs were developed using the fully-burdened, refinery-specific labor rates presented previously (generic EPA labor rate table). Labor estimates for various requirements were developed based on the anticipated number of technical/engineering labor hours required for each task. Except for sampling labor estimates, refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours; no management or administrative hours were associated with the sampling technical labor hours. Daily fuel sampling and CEMS monitoring costs presented previously (EPA CEMS costs) were used for Options 2 and 3 for those sources that were required to measure GHG emissions, but that did not currently have a CEMS. Note that the CEMS costs often include costs for recordkeeping and reporting. As such, the recordkeeping and reporting requirements for a given source may be dependent on whether new CEMS were included.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for the selected option (Option 2)
    i. Initial costs were estimated for the time needed to read the rule, internally develop the methodology, monitoring, and quality assurance plan for calculating emissions from production processes. On average, it would take 80 refinery engineer/technician hours per facility (implying 4 refinery management hours and 8 administrative support hours).
    ii. Monitoring costs (for sampling and analysis) for fuel gas systems, if not present, were estimated as the cost of a "CEMS-Add flow monitor only" plus the cost of "Daily fuel sampling" per fuel gas system.
    iii. Monitoring costs for FCCU/FCU vent coke burn-off CO_2 emissions monitoring were estimated using the "CEMS-Add CO_2 analyzer only" costs.
    iv. Recordkeeping costs were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with recordkeeping.
        A. 1 technical hour per fuel gas systems with existing CEMS
        B. 18.25 technical hours per fuel gas systems using daily sampling
        C. 7 technical hours per flare

D. 1 technical hour per FCCU/FCU

E. 1 technical hour per sulfur recovery unit

F. 1 technical hour per hydrogen plant

G. 4 technical hours per refinery for other process/fugitive emission sources

v. Sampling costs (not included in CEMS costs for daily fuel sampling) were estimated to be 23 technical/engineering labor hours per year per refinery for fugitive emission sources. Note: no management or administrative labor hours are associated with these technical labor hours.

vi. Reporting costs were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with reporting.

A. 20 technical hours per refinery to compile, review and submit report

B. 2 technical hour per fuel gas systems with existing CEMS

C. 1 technical hour per fuel gas systems using daily sampling

D. 2 technical hours per flare

E. 2 technical hours per FCCU/FCU with an existing CO_2 CEMS for coke burn-off

F. 1 technical hour per FCCU/FCU with a newly installed CO_2 CEMS for coke burn-off

G. 2 technical hours per sulfur recovery unit

H. 2 technical hours per hydrogen plant

I. 3 technical hours per refinery for other process/fugitive emission sources

b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 1.

i. Initial costs were estimated for the time needed to read the rule, internally develop the methodology, monitoring, and quality assurance plan for calculating emissions from production processes. On average, it would take 80 refinery engineer/technician hours per facility (implying 4 refinery management hours and 8 administrative support hours).

ii. Monitoring costs for FCCU/FCU vent coke burn-off CO_2 emissions monitoring were estimated using the "CEMS-Add CO_2 analyzer only" costs.

iii. Recordkeeping costs were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with recordkeeping.

A. 1 technical hour per fuel gas systems

B. 7 technical hours per flare

C. 1 technical hour per FCCU/FCU

D. 1 technical hour per sulfur recovery unit

E. 1 technical hour per hydrogen plant

F. 4 technical hours per refinery for other process/fugitive emission sources

iv. Sampling costs (not included in CEMS costs) were estimated to be 23 technical/engineering labor hours per year per refinery for fugitive emission sources. Note: no management or administrative labor hours are associated with these technical labor hours.

v. Reporting costs were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with reporting.

A. 20 technical hours per refinery to compile, review and submit report

B. 2 technical hours per fuel gas systems with existing CEMS

C. 1 technical hour per fuel gas systems using daily sampling

D. 2 technical hours per flare

E. 2 technical hours per FCCU/FCU with an existing CO_2 CEMS for coke burn-off

F. 1 technical hour per FCCU/FCU with a newly installed CO_2 CEMS for coke burn-off

G. 2 technical hours per sulfur recovery unit

H. 2 technical hours per hydrogen plant

I. 3 technical hours per refinery for other process/fugitive emission sources

c. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3.

i. Initial costs were estimated for the time needed to read the rule, internally develop the methodology, monitoring, and quality assurance plan for calculating emissions from production processes. On average, it would take 80 refinery engineer/technician hours per facility (implying 4 refinery management hours and 8 administrative support hours).

ii. Monitoring costs for process heater and boiler vent stacks, when CEMS are not already present, were estimated as the cost of a "CEMS-Add CO_2 analyzer, flow meter, and infrastructure" per process heater/boiler (12 per refinery + 3 solid fuel boilers exceeding 250 MMBtu/hr nationwide).

iii. Monitoring costs for flare CEMS, when not already present, were estimated as the cost of a "CEMS-Add CO_2 analyzer, flow meter, and infrastructure" per flare.

iv. Monitoring costs for FCCU/FCU vent final stack CO_2 emissions monitoring (after CO boiler or similar devices) were estimated using the cost of a "CEMS-Add CO_2

analyzer, flow meter, and infrastructure" per FCCU/FCU stack vent that does not already have CEMS.

v. Monitoring costs for sulfur recovery plants were estimated as the cost of a "CEMS-Add CO_2 analyzer, flow meter, and infrastructure" per sulfur recovery unit when a CEMS is not already present.

vi. Monitoring costs for hydrogen plants were estimated as the cost of a "CEMS-Add CO_2 analyzer, flow meter, and infrastructure" per hydrogen plant when a CEMS is not already present.

vii. Recordkeeping costs (not included in any CEMS costs) were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with recordkeeping.

   A. 2 technical hours per refinery that already have stack CEMS for process heaters/boilers
   B. 7 technical hours per flare that have existing CEMS on flares
   C. 1 technical hour per FCCU/FCU that has an existing CEMS on its final stack
   D. 1 technical hour per sulfur recovery unit that has an existing CEMS on its final stack
   E. 1 technical hour per hydrogen plant that has an existing CEMS on its final stack
   F. 52.93 technical hours per refinery for other process/fugitive emission sources

viii. Sampling costs (not included in any CEMS costs) were estimated to be 120 technical/engineering labor hours per year per refinery for the enhanced fugitive emission estimation methodologies. Note: no management or administrative labor hours are associated with these technical labor hours.

ix. Reporting costs (not included in any CEMS costs) were estimated on an annual basis by source. Refinery management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours associated with reporting.

   A. 20 technical hours per refinery to compile, review and submit report
   B. 4 technical hours per refinery that already have stack CEMS for process heaters/boilers
   C. 2 technical hours per flare that have existing CEMS on flares
   D. 2 technical hours per FCCU/FCU that has an existing CEMS on its final stack
   E. 2 technical hours per sulfur recovery unit that has an existing CEMS on its final stack
   F. 2 technical hours per hydrogen plant that has an existing CEMS on its final stack
   G. 6.73 technical hours per refinery for other process/fugitive emission sources

Assigning Costs to Cost elements

Option 2

Subpart Y—Petroleum Refineries Option 2	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			5	1							90	14			9	1	$6,473	$988
QA/QC			3	1							60	14			6	1	$4,315	$988
Recordkeeping			0.6	0.6							12	12			1.2	1.2	$846	$846
Sampling, Analysis and Calculations											23	23					$1,469	$1,469
Reporting			0.15	0.15							3	3			0.3	0.3	$239	$239
Total	0	0	8	2	0	0	0	0	0	0	188	66	0	0	17	4	$13,343	$4,530

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$55,133	15	$6,054	$56,281	$62,335	$62,335
Performance testing				$0	$0	$0
Recordkeeping				$0	$0	$0
Travel				$0	$0	$0
Total	$55,133		$6,054	$56,281	$62,335	$62,335

Option 1

Subpart Y—Petroleum Refineries Option 1	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			4	1							80	14			8	1	$5,754	$988
QA/QC			3	1							60	14			6	1	$4,315	$988
Recordkeeping			0.6	0.6							12	12			1.2	1.2	$846	$846
Sampling, Analysis and Calculations											7	7					$431	$431
Reporting			0.15	0.15							3	3			0.3	0.3	$239	$239
Total	0	0	8	2	0	0	0	0	0	0	162	49			16	4	$11,585	$3,492

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$16,829	15	$1,848	$12,139	$13,987	$13,987
Performance testing				$0	$0	$0
Recordkeeping				$0	$0	$0
Travel				$0	$0	$0
Total	$16,829		$1,848	$12,139	$13,987	$13,987

Option 3

Subpart Y—Petroleum Refineries Option 3	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning			5	1							90	14			9	1	$6,473	$988
QA/QC			3	1							60	14			6	1	$4,315	$988
Recordkeeping			0.6	0.6							12	12			1.2	1.2	$846	$846
Sampling, Analysis and Calculations											12	12					$752	$752
Reporting			0.15	0.15							3	3			0.3	0.3	$239	$239
Total	0	0	8	2	0	0	0	0	0	0	177	54	0	0	17	4	$12,625	$3,812

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$91,794	15	$10,079	$32,750	$42,829	$42,829
Performance testing				$0	$0	$0
Recordkeeping				$0	$0	$0
Travel				$0	$0	$0
Total	$91,794		$10,079	$32,750	$42,829	$42,829

Estimation of Facility Costs for Each Threshold Level

Monitoring, recordkeeping, and reporting costs for smaller refineries will generally be lower than for larger refineries. Average planning and reporting costs were developed per refinery, so the model plant analysis does not fully represent this variability with plant size and it will tend to overestimate the burden for the smallest refineries and underestimate the burden for the largest refineries. The process-specific portion of the model plant analysis affords some differentiation between larger and smaller plants, but it does not fully capture that difference. For several of the emission sources, an average number of sources were assumed to be present at each plant (e.g., 3 flares per refinery, 2 fuel gas systems servicing 12 process heaters/boilers per refinery), so this model plant analysis does not capture differences in the number of these sources between small and large refineries. There are three sources that exist only at plants that exceed 100,000 tonnes of CO_2 equivalent emissions per year (tCO_2e/yr): the FCU/FCCU processes, the hydrogen plants, and (for Option 3) the three solid fuel fired boilers exceeding 250 MMBtu/hr. For the selected option (Option 2), the average annualized cost per refinery with emissions that exceed 100,000 tCO_2e/yr is $15,874 while the average annualized cost per refinery with emissions less than 100,000 tCO_2e/yr is $14,213. While the cost differences between large and small refineries is expected to be more significant than these values represent, the model plant analysis does afford some variation in the average facility costs for each threshold.

19. SUBPART Z—PHOSPHORIC ACID PRODUCTION

Model Facility Development

For the Phosphoric Acid Production subpart, one model facility was developed using a facility-level inventory for 2006, which represented the known universe of 14 separate phosphoric acid production facilities. Option 3 uses measurement of the inorganic carbon content of the phosphate rock and multiplying by the amount (mass) of phosphate rock used to manufacture phosphoric acid to estimate CO_2 emissions. Phosphoric acid production facilities already have the necessary equipment on-site for conducting chemical analyses of the inorganic carbon weight fraction of the phosphate rock and this analysis is conducted on a routine basis. Therefore no additional testing costs were assigned for the Greenhouse Gas Mandatory Reporting Rule.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for

   i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 16 hours for an industrial engineer/technician, 8 hours for an industrial manager, and 1 hour for a lawyer to review. Per facility, this totals 25 hours. Continued yearly costs related to the monitoring plan equal 4 hours for an industrial engineer/technician, 2 hours for an industrial manager, and 1 hour for a lawyer to review.

   ii. Monitoring costs (for sampling and analysis) total $0 because the only testing required by the rule is already being conducted. Similarly, the O&M costs total $0 per facility.

   iii. Reporting costs total $0 because annual reporting of test results is not required.

Assigning Costs to Cost Elements

Table 19-1.

Subpart Z—Phosphoric Acid Production	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					8	2	1	1					16	4			$1,552.44	$463.86
QA/QC																	$0.00	$0.00
Recordkeeping																	$0.00	$0.00
Sampling, Analysis and Calculations																	$0.00	$0.00
Reporting																	$0.00	$0.00
Total	0	0	0	0	8	2	1	1	0	0	0	0	16	4	0	0	$1,552	$464

Table 19-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)				0	$0	$0
Performance testing				0	$0	$0
Recordkeeping				0	$0	$0
Travel				0	$0	$0
Total			$0	$0	$0	$0

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

20. SUBPART AA—PULP AND PAPER MANUFACTURING

Model Facility Development

For the Pulp and Paper Production subpart, one model facility was developed from an estimated 425 mills based on NCASI Special Report No. 06-07: "Pulp and Paper Mill Emissions of SO_2, NO_X, and Particulate Matter in 2005".

The specific monitoring varies by the type of unit.

- For biomass units, fossil fuel usage should be monitored to determine the fossil-fuel based CO_2, CH_4 and N_2O emissions using the procedures required for stationary fossil fuel combustion sources. Also, the biomass usage should be monitored to calculate biomass CO_2, CH_4, and N_2O emissions using measured or calculated quantities of biomass fuel consumed, default high heat value (HHV), and default emissions factors.
- For Chemical Recovery Furnaces and Chemical Recovery Combustion units, the fossil fuel use should be monitored to calculate fossil-fuel based CO_2, CH_4 and N_2O emissions from direct measurement of fossil fuels consumed and default emissions factors; and the amount of spent pulping liquor should be monitored to calculate biomass CO_2, CH_4 and N_2O emissions using measured quantities of spent liquor solids fired, site-specific HHV, and default or site-specific emissions factors. For sulfite and semichemical facilities, the biomass CO_2 emissions should be based on the measured quantities of spent liquor solids fired and measured carbon content of the spent pulping liquor, and calculate the CH_4 and N_2O emissions using default emissions factors.
- For Lime Kilns, the fossil-fuel based CO_2, CH_4 and N_2O emissions should be calculated from direct measurement of fossil fuels consumed and default HHV and default emissions factors; and biomass CO_2 emissions from conversion of $CaCO_3$ to CaO should be accounted for in the default CO_2 emissions factors for spent pulping liquor used in the Chemical Recovery Furnace biomass CO_2 estimates. Thus, separate biomass CO_2 calculations are not needed for the lime kiln.
- For makeup chemical use, the amount should be monitored to calculate CO_2 emissions using direct or indirect measurement of quantity of chemicals added and default emissions factors.

Monitoring also includes the following fuel monitoring provisions:

- Tier 1: Calculation of biogenic and non-biogenic CO_2 emissions by calculating CO_2 emissions separately for each fuel type and then summing the total biogenic and non-biogenic CO_2 emissions. Calculations are based on annual biomass and fossil fuel usage data, default high heating values, and fuel-specific default CO_2 emissions factors.

- § Tier 2: Same as Tier 1, except that measured high heating values would be used instead of default values for fossil fuels. Biogenic CO_2 emissions would be calculated using default HHV and CO_2 emissions factors.
- § Tier 3: Same as Tier 1, except measured fuel carbon content would be used in place of default HHV and CO_2 emissions factors for fossil fuels. Biogenic CO_2 emissions would be calculated using default HHV and CO_2 emissions factors.
- § Tier 4: Direct measurement of total CO_2 emissions using a CO_2 CEMS; and supplemental calculation of the fossil CO_2 portion (using annual fossil fuel usage data, site specific or default values for high heating values, and fuel-specific default CO_2 emissions factors for fossil fuels). Biogenic CO_2 is then determined to be the difference between the total measured CO_2 emissions from the CEMS and the total calculated CO_2 emissions from fossil fuel combustion.

Costs were evaluated for two different options. Option 1 (the selected option) assumes that pulp and paper mills that already have CEMS will install CO_2 analyzers. Option 2 assumes that pulp and paper mills that already have CEMS will install CO_2 analyzers and mills that do not have existing CEMS will install the CEMS equipment along with CO_2 analyzers.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 1
   i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 18.86 hours per year for an industrial engineer/technician.
   ii. Monitoring costs (for sampling and analysis) were estimated for conducting the monthly measurements of high heating values for black liquor. On average, it would take 12 hours for an industrial engineer/technician. The capital costs include the costs of adding CO_2 analyzers and result in a yearly cost of $14,731. The O&M costs include $157,500 for QA/QC plans which equals $371 per mill.
   iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 2 engineer/technical hours per month for a total of 24 hours per year.
b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 2.
   i. Initial costs were estimated for the time needed to internally develop the methodology and monitoring plan for calculating emissions from production processes. On average, it would take 18.67 hours per year for an industrial engineer/technician.
   ii. Monitoring costs (for sampling and analysis) were estimated for conducting the monthly measurements of high heating values for black liquor. On average, it would take 12 hours for an industrial engineer/technician. The capital costs include the costs of adding CO_2 analyzers and result in a yearly cost of $70,906. This option includes no O&M costs.
   iii. Recordkeeping and reporting costs were estimated on an annual basis, assuming 2 engineer/technical hours per month for a total of 24 hours per year.

Assigning Costs to Cost Elements

Option 1

Table 20-1.

Activity	Labor Hours																Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													18.86	18.86			$1,041.07	$1,041.07
QA/QC																	$0.00	$0.00
Recordkeeping													24	24			$1,324.80	$1,324.80
Sampling, Analysis and Calculations													12	12			$662.40	$662.40
Reporting																	$0.00	$0.00
Total	0	0	0	0	0	0	0	0	0	0	0	0	54.86	54.86	0	0	$3,028.27	$3,028.27

Table 20-2.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$34,927	5	$14,731	$371	$15,102	$15,102
Performance testing						
Recordkeeping						
Travel						
Total			$14,731	$371	$15,102	$15,102

Option 2

Table 20-3.

Activity	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning													18.67	18.67			$ 1,030.58	$1,030.58
QA/QC																	$ 0.00	$0.00
Recordkeeping													24	24			$1,324.80	$1,324.80
Sampling, Analysis and Calculations													12	12			$662.40	$662.40
Reporting																	$0.00	$0.00
Total	0	0	0	0			0	0	0	0	0	0	54.67	54.67	0	0	$3,017.78	$3,017.78

Table 20-4.

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$164.383		$70,906	$0	$70,906	$70,906
Performance testing				$0	$0	$0
Recordkeeping				$0	$0	$0
Travel				$0	$0	$0
Total	$164,383		$70,906	$0	$70,906	$70,906

Estimation of Facility Costs for Each Threshold Level

Costs per facility do not vary by threshold level because a representative model plant was used as the basis.

21. SUBPART CC—SODA ASH MANUFACTURING

22. SUBPART DD—ELECTRIC POWER SYSTEMS

Table 22-1. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities
1,000	578
10,000	183
25,000	141
100,000	35

STEP 1: Model Facility Development

The model facility for electric power systems is an electric utility that operates an average amount (nameplate capacity) of SF_6-containing transmission equipment. Costs are not expected to vary widely among utilities because all utilities would track the same set of quantities (SF_6 stored, acquired, and disbursed; equipment installed and retired), and the costs of tracking and reporting these quantities are relatively modest.

The model facility is assumed to already have the capital and technical capability to monitor and report emissions of SF_6 using a mass-balance formula. To use the formula, facilities must track their SF_6 inventory in cylinders, SF_6 acquisitions, and SF_6 disbursements, as well as their equipment commissioning and decommissioning. These data are already tracked by utilities, but not necessarily as closely and comprehensively as required to develop all utility level mass-balance inputs. Thus, as discussed below, the model facility is assumed to incur some costs for tracking and reporting SF_6 emissions.

STEP 2: Determine Cost Elements

The total costs associated with the proposed rulemaking for electric power systems were estimated using labor hours from an Information Collection Request (ICR) performed for EPA's SF_6 Emission Reduction Partnership.[1] The labor hours were multiplied by current labor costs to calculate the reporting costs under the proposed reporting rule.

All labor costs are considered on an annual basis and are divided into the following four categories:

[1] EPA. (2000). Supporting statement for EPA Information Collection Request number 1933.01 "Information collection activities associated with EPA's SF_6 Emission Reduction Partnership for Electric Power Systems."

1. Regulation Compliance Determination Costs
    a. Recurring costs consist of reviewing the instructions of the mass-balance reporting form and associated materials to ensure the proper procedures are in place to obtain technically accurate inputs.
2. Monitoring Costs
    b. Recurring costs consist of gathering information for the mass-balance reporting form and associated materials. The information gathered represents the movement of SF_6 throughout the system. Since SF_6 is often handled and stored at the substation level, collecting information is usually a bottom-up process that is the most labor-intensive activity in the reporting process.
3. Reporting Costs
    c. Recurring costs consist of completing and reviewing the information requested by the mass-balance reporting form and associated materials as well as submitting all materials.
4. Recordkeeping Costs
    d. Recurring costs consist of maintaining a record of the emissions inventory and documentation.

STEP 3: Analyze Proportion of Facilities in Different Model Facility Levels

There is only one model facility for electric power systems.

STEP 4: Assigning Costs to Cost Elements

►Determine Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with the compliance, monitoring, reporting, and recordkeeping activities, but also to determine who will perform each task. For this analysis, three labor categories were used as shown in Table 22-2.

Table 22-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements. Reviews reporting forms to ensure accuracy and consistency	$71.03/hour
Technical	Compiles data to develop mass-balance inputs. Performs emission calculations on reporting form	$55.20/hour
Clerical	Assists with documentation and recording information	$29.65/hour

►*Allocate Responsibilities and Estimate Labor Hours*

Labor hours for all cost elements were estimated based on consultation between EPA and SF_6 Emission Reduction Partners conducted for the 2000 Partnership ICR. Table 22-3 summarizes the allocation of hours and responsibilities by labor category.

Table 22-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities and Hours by Labor Category						Per Facility/ Per Company
	Managerial		Technical		Clerical		
	Responsibilities	Hours	Responsibilities	Hours	Responsibilities	Hours	
Regulation Compliance Determination Costs							
Review the instructions, SF_6 mass-balance reporting form, and associated materials	Review the instructions to the level required to perform oversight responsibilities	1	Review the instructions to the level required to compile data and perform necessary calculations	1.5			Per facility
Monitoring Costs							
Gather information for the SF_6 mass-balance reporting form and associated materials	Institute and oversee proper data collection procedures that account for all SF_6 within the system	4	Compile SF_6 data and sort data into appropriate input categories for the mass-balance formula	17	Perform measurements and collect documentation that track SF_6 gas movements	11	Per facility
Reporting Costs							
Complete and review the information requested by the SF_6 mass-balance reporting form and associated materials	Review reporting forms to ensure accuracy and consistency	3.5	Calculate inputs for the mass-balance reporting form. Perform facility-wide SF_6 emission calculations	3.5	Provide data and supporting documentation to technical and managerial staff	1.5	Per facility
Submit the SF_6 mass-balance reporting form and associated materials		0		0	Combine the mass-balance reporting form with all necessary materials and submit	0.2	Per facility
Recordkeeping Costs							
Maintain a record of the emissions inventory and documentation		0		0	File the mass-balance reporting form and associated materials into the recordkeeping system	0.2	Per facility

►***Other Costs***

Other costs consist of postage costs—for submitting materials in a one ounce package, and photocopying costs—for maintaining records of the reporting form and associated materials. These costs were gathered by EPA in the SF_6 Emission Reduction Partnership ICR.

Table 22-4. Other Costs Associated with Reporting and Recordkeeping

Element	Description	Costs ($)
Postage costs	Postage costs for submitting the reporting form and associated materials	$0.38
Photocopying costs	Photocopying costs for maintaining a record of the emissions inventory and associated materials	$11.66

STEP 5: Estimate per Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. Other costs, consisting of postage and photocopying, were then added to the labor costs to calculate the total cost per facility. For calculating national costs, the total cost per facility was multiplied by 141, which is the number of facilities that exceed the reporting threshold.

23. SUBPART EE—TITANIUM DIOXIDE PRODUCTION

24. SUBPART FF—FUGITIVE EMISSIONS: COAL MINES

This source category consists of active underground coal mines, and other underground mines having operational pre-mining degasification systems. An underground coal mine is a mine at which coal is produced by tunneling into the earth to a subsurface coal seam, where the coal is then mined with equipment such as cutting machines, and transported to the surface. Active underground coal mines are mines where coal is currently being produced or has been produced within the previous 90 days. This source category is comprised of the following emission points of fugitive methane emissions for each coal mine exceeding an emissions threshold established by a current emissions monitoring program in place by the Mine Safety and Health Administration (MSHA):

- Each ventilation well or shaft; and
- Each degasification system well or shaft, including degasification systems deployed before, during, or after mining operations are conducted in a mine area.

This source category does not include abandoned (closed) mines, surface coal mines, or post-coal mining activities.

For coal mine ventilation shafts, the recommended approach was for quarterly sampling of methane content and gas flow, essentially duplicating a current Mine Safety and Health Administration (MSHA) process of collecting air samples and ventilation rates, submitting the samples to a lab for analysis, and developing estimates of emissions on their own. For coal mine degasification systems, the fugitive emissions monitoring approach recommended was direct monitoring using continuous wellbore monitors of gas recovered from mine degasification systems, including all degasification wells, as well as gob gas vent holes and other degasification wells that are currently not monitored.

These options are summarized in Table 24-1.

Table 24-1. Summary of Monitoring Cost Scenarios

Scenario	Comment
Coal mining: Underground coal mines; ventilation with quarterly sampling, annual reporting	Annual company reporting of mandatory sampling conducted by trained MSHA personnel or mine personnel as part of quarterly mine safety inspections for gassy mines, annual reporting for other mines
Coal mining: Underground coal mines; all mine degasification systems—Monitoring using continuous well bore monitors	Company reporting of produced gas volumes and disposition of gas produced from degasification systems—using continuous wellbore monitors. Applies to both active degasification systems and gob gas vent holes for longwall mines.

1. Model Facility Development

For purposes of this RIA, actual coal mines were used for cost development. Each mine exceeding the MSHA threshold was assumed to have two ventilation shafts where quarterly sampling was conducted. For mine degasification systems, only those systems where degasification systems are in place were considered. For these facilities, one degasification well per facility was assumed. For remote gob gas vent wells/holes that do not currently monitor degasified gas volumes produced, incremental costs are also associated with installing simple monitoring equipment on these remote gob gas vent holes. For purposes of developing costs, five gob wells were assumed per long wall panel, applied to the approximately 40 long wall mines in the United States that do not monitor such vents.[1]

2. Cost Elements

1. Regulation compliance determination costs, reporting, recordkeeping, archiving and auditing costs are not included in this appendix. Please refer to Section 4.2 for more information.
2. Monitoring costs.
    a. All costs associated with complying with the rulemaking for monitoring fugitive emissions from coal mines were considered, including both labor and non-labor (capital and O&M) costs, for both startup and recurring costs. Specifically, this includes costs, as appropriate to the option considered, associated with pre-compliance planning and preparation, system planning and equipment selection and purchase, installing and testing new equipment, and ensuring monitoring equipment are properly maintained and functioning. In the case where mine operators would merely duplicate monitoring already conducted by MSHA at mines exceeding MSHA-defined emission thresholds, costs include those associated with oversight, auditing, and/or duplication of MSHA quarterly inspections to estimate ventilation air emissions, internally developing the

[1] Personal communication, Fred H. Menke, Jr., Supervisory IT Specialist, Mine Safety and Health Administration, to Michael Godec, Advanced Resources International, April 25, 2008.

methodology for estimating emissions from coal mine ventilation air; training personnel in the process, having mine personnel accompany inspectors conducting quarterly mine safety inspections and in taking the mine air samples, obtaining the mine air sample and air ventilation results from MSHA inspectors, sending mine ventilation air samples to a lab for analysis, including the costs of the lab testing of the samples, and developing estimates of emissions based on these samples.

3. Proportion of Facilities in the Different Model Facility Levels

In general, MSHA samples (quarterly or more frequently) and electronically keeps track of methane emissions for mines liberating more than 100,000 cubic feet of per day from ventilation systems, which is equivalent to about 15,000 metric tons CO_2e per year. However, emissions rates from some mines emitting less than that threshold are included in the MSHA database. Of the over 600 underground coal mines operating in the United States according to EIA, ventilation air emissions based on MSHA inspections were reported and electronically accounted for in 128 mines in 2006. Thus, the number of mines exceeding the MSHA threshold was determined based on MSHA data. In 2006, 114 mines exceeded the MSHA threshold.

The number of mines with mine degasification systems was also determined based on data collected by MSHA and EPA. In 2006, 20 U.S. coal mines supplemented their ventilation systems with active degasification systems.

In addition, as discussed above, an estimated 40 longwall mines in the United States do not monitor vents from remote gob gas vent wells/holes that are being used to degasify longwalls prior to mining. These longwall mines would be required to monitor degasified gas volumes by installing simple monitoring equipment on these remote gob gas vent holes. For purposes of developing costs, five gob wells were assumed per longwall panel

4. Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

Determining Labor Categories

Three labor categories were used as shown in Table 24-2

Table 24-2. Labor Costs Used in the Analysis

Labor Category	Loaded Hourly Rate (2006$)
Industrial Manager	$71.03
Lawyer	$101.00
Industrial Engineer/Technician	$55.20
Administrative Support	$29.65

Notes:

* These rates reflect adjustments of manufacturing sector's average productivity increase of 3.7% per year for 6 quarters between 2006 Q2 and 2007 Q4, based on the estimate released by the Bureau of Labor Statistics in March 2008.

2006 Q2 labor rates were obtained from the ICF Nov, 2007 report.

Refer to ICF Nov. 2007 Report's supporting documentation for details on the wage rate calculation methodology.

Source:

Supporting Document for "Mandatory GHG Reporting Burden Assessment—Preliminary Draft." ICF, 2007.

Productivity and Costs, Fourth Quarter and Annual Averages, 2007. Revised, Bureau of Labor Statistics, March 5, 2008.

Allocating Responsibilities

Assigning labor hours for all cost elements was based on expert judgment. When assigning hours, role of the labor categories were taken into consideration. Table 24-3 summarizes these roles. Table 24-4 summarizes the labor hours per labor category.

Capital Cost Annualization and O&M Costs

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection and emissions measurement. All costs are reported in 2006 U.S. dollars. Capital annualization was calculated assuming a 7% discount rate. Ventilation shaft air sampling devices are assumed to have a 3-year lifetime and the monitoring equipment for gob gas vent hole degasification systems for longwall mines is assumed to have a 5-year lifetime. From these factors, a capital recovery factor was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 24-5 below summarizes the capital costs associated with the monitoring program. Additionally, the table describes the annual costs of travel, lodging, and shipping—the only other non-labor costs related to the monitoring program.

Table 24-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	Lawyer	Industrial Engineer/Technician	Administrative Support	Per Facility/ per Company*
Registration					
Facility data	To be provided by EPA	—	—	—	Per facility
Regulation review	To be provided by EPA	—	—	—	Per facility
Monitoring					
Plan development	To develop and review the monitoring plan		To develop a monitoring plan		Per facility
Equipment purchase	To approve the equipment purchase		To identify and purchase the equipment		Per facility
Material sampling	To review sampling data		To conduct sampling		Per facility
Start-up/training	To provide and acquire training		To acquire training	To acquire training	Per facility
Reporting					
Data documentation	To be provided by EPA	—	—	—	Per facility
Report submission	To be provided by EPA	—	—	—	Per facility
Archiving and Recordkeeping					
Archiving reports	To be provided by EPA	—	—	—	Per facility
Auditing					
Audit	To be provided by EPA	—	—	—	Per facility
Audit follow-up	To be provided by EPA	—	—	—	Per facility

Table 24-4. Labor Costs and Labor Hours Used in the Analysis

Industrial Source Category	Operating Period	Total Annual Labor Hours			
		Industrial Manager	Lawyer	Industrial Engineer	Admin Support
Coal—Monitoring Ventilation Air					
Coal mining	First year	56		184	16
	Subsequent years	56		184	16
Coal—Degasification Systems					
Coal mining	First year	8		76	5
	Subsequent years	4		64	2

Emissions in Ventilation Air

Coal mine operators would be required to duplicate the MSHA process of collecting air samples and ventilation rates, submitting the samples to a lab for analysis, and developing estimates of emissions on their own. This process would require mine operators to purchase

sampling equipment, train personnel in their use, develop emissions estimates based on the data collected, and report the results. If this option is pursued, the operator would have to incur the capital and O&M costs involved in purchasing and maintaining the air sampling equipment, and in sending air samples to an independent lab for analysis. A basic air sampling kit costs on the order of $300 per kit, and the price for gas analysis is estimated to be approximately $500 per sample. For cost estimation purposes, each mine is assumed to keep four mine air sample kits on site, and that these kits have a 3-year life. In addition, on average, two samples are assumed to be sent each quarter for analysis for each mine. The two key activities are summarized below.

- Each facility needs to internally develop procedures for either obtaining the results of the MSHA sampling and air ventilation measurements, and/or independently estimating ventilation air emissions. Facility managers need to review such procedures and results annually.
- Mine personnel are required to obtain the mine air sample and air ventilation results from MSHA inspectors or take their own samples, determine ventilation air emissions, and report results to EPA annually.

These activities would involve labor hours for industrial managers, industrial engineers or technicians, and administrative support, as summarized in Tables 3 and 4 above.

Emissions Avoided from Degasification Systems

Operators deploying degasification systems in underground mines would install continuous monitors on all degasification wells. If pre-mining degasification wells are either selling, destroying (flaring), or using the gas produced from such degasification systems, produced gas volumes are presumably already being measured.

A vast range of flow meters are available for gas production wells;[2] and such flow meters are a standard feature of most wellhead designs. Measurement packages are evolving to develop systems specifically appropriate for the characteristics of coal bed and coal mine degasification wells,[3] with low production volumes, low pressures, and high water production rates. A wide variety of options are available, with costs ranging from $500 to $3,000 per instrument, depending on application and operating environment.[4] Such instrumentation provides the capability of continuous monitoring.

Under this option, for degasification wells already deploying continuous monitoring, the incremental costs would only involve annual reporting of the degasified gas volumes produced

[2] See, for example, http://www.gesensing.com/downloads/datasheets/br_126a.pdf
[3] http://www.crimtech.com/manufactured/p-CBM.pdf
[4] http://www.instrumart.com/ProductList.aspx?CategoryID=3056,

and the disposition of this gas (sold, vented, consumed on site). Gob gas vent hole wells are less likely to be currently monitored, so some cost for installing meters on these wells would most likely need to be incurred.

The steps involved in this process include:

1. Each facility needs to internally develop procedures for continuous monitoring of produced volumes and disposition of emissions from underground mine degasification systems. Facility managers are required to review such procedures and results annually.
2. Mine personnel are required to ensure that continuous monitoring equipment is properly maintained and functioning.
3. Mine personnel would need to acquire results from monitoring systems and report results to EPA.

No incremental costs were assumed to be incurred by mine operators to monitor and/estimate the volume and disposition of methane produced from active underground coal mining degasification systems, since these systems are presumably already being monitored. For new systems that would be deployed, the costs for installing monitoring equipment for such wells would be approximately $5,000.

For remote gob gas vent wells/holes that do not currently monitor degasified gas volumes produced, incremental costs would also be associated with installing simple monitoring equipment on these remote gob gas vent holes. Incremental costs of $5,000 per gob gas vent hole (including one meter installed and one backup) can be assumed where gas production is currently not monitored. At a 7% interest rate, this amounts to incremental annualized costs of $1,220 per well/hole, assuming that the life of each gob gas vent hole is 5 years.

About 5 gob wells per long wall panel are assumed to exist, and there are about 40 long wall mines in the United States that do not monitor such vents. Based on these assumptions, total incremental costs would amount to $1,000,000 total capital costs ($5,000 x 5 x 40), or total annualized costs of $244,000 ($1,220 x 5 x 40).

Capital costs associated with ensuring this monitoring equipment is properly maintained and functioning are assumed to be the same as that represented in Table 24-4.

Table 24-4. Sampling Costs Used in the Analysis

Industrial Source Category	Labor Cost per Reporting Unit/Facility		Annualized Cost of Capital		Operation and Maintenance Costs		Total Reporting Unit/ Facility Cost (Annualized Labor + Capital + O&M)	
Activity	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years
Coal—Monitoring Ventilation Air								
Internally develop the methodology for estimating emissions from coal mine ventilation air; train personnel in the process	$7,494	$7,494					$ 7,494	$ 7,494
Mine personnel accompany inspectors conducting quarterly mine safety inspections and in taking the mine air samples, obtain the mine air sample and air ventilation results from MSHA inspectors, determine ventilation air emissions.	$4,219	$4,219					$ 4,219	$ 4,219
Sending mine ventilation air samples to lab for analysis ($500 / sample x 2 samples per testing x 4 per year)	$442	$442			$4,000	$4,000	$ 4,442	$ 4,442
Purchase sampling devices and take quarterly samples	$2,453	$2,453	$ 457	$ 457			$ 2,910	$ 2,910
SUBTOTAL	**$14,608**	**$14,608**	**$457**	**$457**	$4,000	$4,000	**$19,066**	**$19,066**
Coal—Degasification Systems								
Internally develop the methodology for estimating emissions avoided from coal mine degasification systems	$393						$ 393	
Ensure continuous monitoring equipment are properly maintained and functioning	$1,766	$1,766					$ 1,766	$ 1,766
Mine personnel would need to acquire results from monitoring systems quarterly and report results to EPA annually.	$2,169	$2,110					$2,169	$ 2,110
Install continuous emissions monitoring system equipment on each degasification well/vent hole/ replace every 5 years	$584	$0	$6,079	$6,079			$ 6,681	$6,097
SUBTOTAL	**$4,911**	**$3,876**	**$6,079**	**$6,079**			**$11,009**	**$9,973**

5. Estimation of Facility Costs for Each Emission Source

The total monitoring costs for monitoring fugitive emissions in mine ventilation systems was determined by multiplying the unit costs by the number of mines estimated by MSHA that exceed their reporting threshold of 15,000 tonnes per year. Monitoring costs for emissions (and emissions collected) from mine degasification systems currently not being monitored (longwall mines using gob gas vent holes) was determined by multiplying the unit costs for such degasification systems times the number of long wall mines using these systems (40 longwall mines).

Again, no incremental costs were assumed to be incurred by mine operators to monitor and/estimate the volume and disposition of methane produced from active underground coal mining degasification systems, since these systems are presumably already being monitored.

6. Nationwide Cost Estimates for Proposed Monitoring Option

Nationwide cost estimates were developed for the proposed monitoring option for mine shaft ventilation and mine degasification systems as discussed above. The projected nationwide costs for the proposed option are provided in Table 24-6.

Table 24-6. Nationwide Cost for Proposed Monitoring Options

Industrial Source Category	Proposed Monitoring Option	Number of Reporting Facilities	Total Nationwide Annualized Cost (2006$/yr)	
			First Year	Subsequent Years
Coal—Monitoring Ventilation Air	Quarterly sampling of methane content and gas flow, essentially duplicating a current Mine Safety and Health Administration (MSHA) process of collecting air samples and ventilation rates, submitting the samples to a lab for analysis, and developing estimates of emissions on their own.	114 facilities exceeding MSHA threshold of 15,000 tonnes per year	$2,173,477	$2,173,477
Coal –Active Mine Degasification Systems	Direct monitoring using continuous wellbore monitors of gas recovered from active mine degasification systems.	20 mines currently deploying mine degasification systems	$0	$0
Coal –Gob gas vent holes for longwall mines	Direct monitoring using continuous wellbore monitors of gas vented or recovered from as gob gas vent holes currently not monitored.	40 longwall mines deploying gob gas vent holes, with 5 gob wells/holes assumed per longwall mine	$440,348	$398,930
Total			**$2,613,825**	**$2,572,407**

25. SUBPART GG—ZINC PRODUCTION

26. SUBPART HH—LANDFILLS

Model facility development

For the Landfill subpart, costs were developed using three model plants: one model plant representing municipal solid waste (MSW) landfills that do not have gas collection systems for the recovery or flaring of landfill gas; one model plant representing MSW landfills that do have gas collection and recovery systems or flares; and one model plant representing industrial waste landfills (none of which are known to have gas collection systems). Three general options were evaluated. Option 1 is referred to as the modeling method and uses model estimates for all landfills. Option 2 is referred to as the engineering method and uses a mixture of modeling for landfills and measurement techniques for capture systems. Option 3 uses direct measurement methods to measure the amount of methane released from the landfill surface.

For all options, costs were developed using the fully-burdened, "industrial" labor rates presented previously (generic EPA labor rate table). Labor estimates for various requirements were developed based on the anticipated number of technical/engineering labor hours required for each task. Industrial management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours. For Options 1 and 2 that use model estimates for methane generation, first year costs are higher than subsequent year costs due to the need to set-up the model and collect historical data for the first year. Industrial landfills are expected to have a much more homogeneous and consistent waste stream than MSW landfills, so the labor estimates for MSW landfills are higher than for industrial landfills to collect and maintain records of waste composition.

CEMS monitoring costs presented previously (EPA CEMS costs) for "CEMS-Add CO_2 analyzer, flow meter, and infrastructure" were used to estimate the cost of monitoring capture system flow and methane composition for collection systems that do not have existing monitoring systems (for Options 2). It was assumed that 90 percent of MSW landfills that have collection systems would have appropriate CEMS in-place. CEMS costs were not readily available for direct monitoring techniques for landfills (Option 3). These monitoring costs were estimated based on a discussion with a supplier that had installed and operated a continuous fenceline monitoring system for an industrial plant. Based on the available information, the costs per landfill for a direct measurement monitoring system are: $500,000 initial capital equipment and installation costs; $54,900/year annualized cost of equipment (based on 15 year equipment life and an annual interest rate of 7 percent); and $50,000/year annual operating and maintenance costs. These costs are expected to include QA/QC, recordkeeping, and analysis costs associated

with the monitoring system. No landfills are expected to have direct monitoring systems in-place.

a. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for the selected option (Option 2)

   i. Initial planning costs were estimated for the time needed to read the rule and internally determine the reporting needs for the landfills. On average, it would take 10 industrial engineer/technician hours per landfill. These costs apply to both MSW landfills and industrial landfills.

   ii. First year costs for developing a QA/QC plan were estimated to be 5 industrial engineer/technician hours per landfill. Subsequent year costs to implement the QA/QC plan were estimated to be 2 industrial engineer/technician hours per landfill on an annual basis. These costs apply to both MSW landfills and industrial landfills.

   iii. First year recordkeeping costs for MSW landfills were estimated to be 20 industrial engineer/technician hours per MSW landfill. Subsequent year recordkeeping costs for MSW landfills were estimated to be 12 industrial engineer/technician hours per MSW landfill on an annual basis.

   iv. First year recordkeeping costs for industrial landfills were estimated to be 12 industrial engineer/technician hours per industrial landfill. Subsequent year recordkeeping costs for industrial landfills were estimated to be 8 industrial engineer/technician hours per industrial landfill on an annual basis.

   v. First year calculation costs for MSW landfills were estimated to be 12 industrial engineer/technician hours per MSW landfill. Subsequent year recordkeeping costs for MSW landfills were estimated to be 2 industrial engineer/technician hours per MSW landfill on an annual basis.

   vi. First year recordkeeping costs for industrial landfills were estimated to be 10 industrial engineer/technician hours per industrial landfill. Subsequent year recordkeeping costs for industrial landfills were estimated to be 2 industrial engineer/technician hours per industrial landfill on an annual basis

   vii. First year reporting costs were estimated to be 3 industrial engineer/technician hours per landfill. Subsequent year reporting costs were estimated to be 2 industrial engineer/technician hours per landfill on an annual basis. These costs apply to both MSW landfills and industrial landfills.

   viii. Industrial management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours for all planning, QA/QC, recordkeeping, calculating, and reporting activities.

   ix. Monitoring costs for MSW landfills that have landfill gas collection systems but do not have existing CEMS were estimated as the cost of a) for "CEMS-Add CO_2 analyzer, flow meter, and infrastructure." The costs per applicable landfill for a direct

measurement monitoring system are: $119,012 initial capital equipment and installation costs; $13,067/year annualized cost of equipment (based on 15 year equipment life and an annual interest rate of 7 percent); and $34,803/year annual operating and maintenance costs.

b. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 1.

   i. Initial planning costs were estimated for the time needed to read the rule and internally determine the reporting needs for the landfills. On average, it would take 10 industrial engineer/technician hours per landfill. These costs apply to both MSW landfills and industrial landfills.

   ii. First year costs for developing a QA/QC plan were estimated to be 5 industrial engineer/technician hours per landfill. Subsequent year costs to implement the QA/QC plan were estimated to be 2 industrial engineer/technician hours per landfill on an annual basis. These costs apply to both MSW landfills and industrial landfills.

   iii. First year recordkeeping costs for MSW landfills were estimated to be 20 industrial engineer/technician hours per MSW landfill. Subsequent year recordkeeping costs for MSW landfills were estimated to be 12 industrial engineer/technician hours per MSW landfill on an annual basis.

   iv. First year recordkeeping costs for industrial landfills were estimated to be 12 industrial engineer/technician hours per industrial landfill. Subsequent year recordkeeping costs for industrial landfills were estimated to be 8 industrial engineer/technician hours per industrial landfill on an annual basis.

   v. First year calculation costs for MSW landfills were estimated to be 12 industrial engineer/technician hours per MSW landfill. Subsequent year recordkeeping costs for MSW landfills were estimated to be 2 industrial engineer/technician hours per MSW landfill on an annual basis.

   vi. First year recordkeeping costs for industrial landfills were estimated to be 10 industrial engineer/technician hours per industrial landfill. Subsequent year recordkeeping costs for industrial landfills were estimated to be 2 industrial engineer/technician hours per industrial landfill on an annual basis

   vii. First year reporting costs were estimated to be 3 industrial engineer/technician hours per landfill. Subsequent year reporting costs were estimated to be 2 industrial engineer/technician hours per landfill on an annual basis. These costs apply to both MSW landfills and industrial landfills.

   viii. Industrial management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours for all planning, QA/QC, recordkeeping, calculating, and reporting activities.

   ix. There are no monitoring costs under Option 1.

c. All costs associated with complying with the rulemaking both labor and non-labor (capital and O&M) for both startup and recurring costs for Option 3.

   i. Initial planning costs were estimated for the time needed to read the rule and internally determine the reporting needs for the landfills. On average, it would take 10 industrial engineer/technician hours per landfill. These costs apply to both MSW landfills and industrial landfills.

   ii. First year reporting costs were estimated to be 3 industrial engineer/technician hours per landfill. Subsequent year reporting costs were estimated to be 2 industrial engineer/technician hours per landfill on an annual basis. These costs apply to both MSW landfills and industrial landfills.

   iii. Industrial management hours were estimated to be 5 percent of the technical labor hours and administrative support hours were estimated to be 10 percent of the technical labor hours for all planning, QA/QC, recordkeeping, calculating, and reporting activities.

   iv. Monitoring costs per landfill for a direct measurement monitoring system were estimated to be: $500,000 initial capital equipment and installation costs; $54,900/year annualized cost of equipment (based on 15 year equipment life and an annual interest rate of 7 percent); and $50,000/year annual operating and maintenance costs. These costs apply to both MSW landfills and industrial landfills.

Assigning Costs to Cost elements

Option 2

Landfills Option 2 (Selected Option)	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager $88.79		Refinery Manager $101.31		Industrial Manager $71.03		Lawyer $101.00		Electricity Eng/ Tech $60.84		Refinery Eng/Tech $63.89		Industrial Eng/Tech $55.20		Admin $29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					1	0							10		1		$617	$0
QA/QC					0.25	0.10							5	2	0.50	0.20	$309	$123
Recordkeeping					0.80	1							16	10	1.6	1	$987	$617
Sampling, Analysis and Calculations													11	2	1.1	0.20	$640	$116
Reporting					0.15	0.10							3	2	0.30	0.20	$185	$123
Total	0	0	-	-	1.70	0.70	-	-	-	-	-	-	45	16	4.50	1.60	$2,738	$980

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$119,012	15	$13,067	$34,803	$47,870	$47,870
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$119,012		$13,067	$34,803	$47,870	$47,870

Option 1

Landfills Option 1	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager $88.79		Refinery Manager $101.31		Industrial Manager $71.03		Lawyer $101.00		Electricity Eng/ Tech $60.84		Refinery Eng/Tech $63.89		Industrial Eng/Tech $55.20		Admin $29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					1	-							10	-	1	-	$617	-
QA/QC					0.25	5							5	101	1	10	$309	$6,233
Recordkeeping					1	1							16	10	2	1	$987	$617
Sampling, Analysis and Calculations													11	2	1	0.2	$640	$116
Reporting					0.15	0.10							3	2	0.3	0.2	$185	$123
Total	0	0	-	-	1.7	5.65	-	-	-	-	-	-	45	115	4.5	11.5	$2,738	$7,090

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$0	0	$0	$0	$0	$0
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$0		$0	$0	$0	$0

Option 3

Landfills Option 3	Labor Hours														Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Electricity Manager		Refinery Manager		Industrial Manager		Lawyer		Electricity Eng/ Tech		Refinery Eng/Tech		Industrial Eng/Tech		Admin			
	$88.79		$101.31		$71.03		$101.00		$60.84		$63.89		$55.20		$29.65			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Planning					0.50	0							10	0	1	0	$617	$0
QA/QC					0.25	0.10							5	2	0.5	0.2	$309	$123
Recordkeeping					0.80	0.50							16	10	1.6	1	$987	$617
Sampling, Analysis and Calculations													11	2	1.1	0.2	$640	$116
Reporting					0.15	0.10							3	2	0.3	0.2	$185	$123
Total	-	-	-	-	1.70	0.70	-	-	-	-	-	-	45	16	4.5	1.6	$2,738	$980

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subseq. Year
Equipment (selection, purchase, installation)	$500,000	15	$54,900	$50,000	$104,900	$104,900
Performance testing					$0	$0
Recordkeeping					$0	$0
Travel					$0	$0
Total	$500,000		$54,900	$50,000	$104,900	$104,900

Estimation of Facility Costs for Each Threshold Level

Using the model plant analysis employed for the Landfill subpart, the average cost per reporting landfill may differ for different reporting thresholds, depending on the option being evaluated.

For Option 1, the average cost per MSW landfill and the average cost per industrial landfill are different, but neither is dependent on landfill size. However, the average size of industrial landfills differs slightly from the average size of MSW landfills so that the relative fraction of MSW to industrial landfills is dependent on the reporting threshold. Thus, when looking only at MSW landfills, the average cost per reporting MSW landfill is fixed for any threshold, and when looking only at industrial landfills, the average cost per reporting industrial landfill is fixed for any threshold. However, when looking at the combination of MSW landfills and industrial landfills, the average cost per landfill does differ slightly for different reporting thresholds.

For Option 2, the average cost per reporting MSW landfill is dependent on the reporting threshold. Landfill gas collection systems are generally installed on larger landfills. As such, larger MSW landfills have a higher proportion of the monitoring (CEMS) costs than smaller landfills. Consequently, the average overall reporting cost for small MSW landfills is lower than the average overall reporting cost for larger MSW landfills. As industrial landfills do not employ landfill gas collection, the average cost per reporting industrial landfill is fixed for any threshold. When looking at the combination of MSW landfills and industrial landfills, the average cost per landfill differs for different reporting thresholds, primarily because of the distribution of gas collection systems at MSW landfills.

For Option 3, none of the landfills are expected to have a direct measurement system. The cost of the fenceline monitoring system is expected to be fairly independent of landfill size and independent of landfill type (MSW versus industrial landfills). As such, the average overall reporting costs per landfill is fixed for all landfills and there is no change in the average reporting costs per landfill for the different reporting thresholds.

27. SUBPART II—WASTEWATER TREATMENT

STEP 1: Model Facility Development

For this source category, EPA evaluated pulp and paper mill wastewater treatment plants and petroleum refinery wastewater treatment plants to represent the types of wastewater treatment systems with the greatest potential to exceed the GHG threshold.

For each industry category, EPA first attempted to locate any plant-level datasets that would allow direct calculation of greenhouse gas emissions by plant. Where plant-level data were incomplete, EPA used default national-level data from the National Inventory to fill in missing data. Where plant-level data were unavailable, EPA instead determined the production levels for each industry that would trigger emissions over any of the thresholds of interest, and used best professional judgment to estimate how many plants would meet the production levels.

For pulp and paper mills, EPA used the most readily available plant-level dataset, which contains 94 of the largest U.S. pulp and paper mills (as of 1995). The dataset contains pulp production data collected by U.S. EPA's Office of Water during development of national effluent limitation guidelines and standards for this industry. As such, the mills are not identified by name. Because the dataset did not include plant-specific information on wastewater generation rates, influent BOD or COD levels, or treatment processes on site, EPA used default values from the National Inventory.

For petroleum refiners, EPA obtained a plant-specific dataset from the Energy Information Administration (EIA), with refinery capacity for all facilities as of January 2007. The EIA data did not include plant-specific information on wastewater generation rates, influent BOD or COD levels, or treatment processes on site. Therefore, EPA used default values from the National Inventory and other reporting guidelines.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs.

1. Monitoring costs

    a. Start-up monitoring costs consist of both labor and capital costs. Capital investment will be required for purchasing monitoring equipment. This capital

cost will be accounted as annualized cost on an annual basis. Labor will be required for product research for monitoring instruments before actual purchase. Before actual monitoring takes place, labor will have to be devoted to the development of a monitoring plan. EPA assumed that each plant would develop its own monitoring plan, and that selected employees are already trained on how to use the monitoring equipment.

b. Recurring monitoring costs consist of labor required to conduct detection and measurement of emissions (i.e., perform actual monitoring of emissions). EPA assumed that each plant would conduct monitoring onsite.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

EPA estimated the number of pulp and paper mills and petroleum refining plants using plant-specific datasets, as described in Step 1. ’

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►Determining Labor Categories

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, three labor categories were used as shown in Table 27-2.

►Allocating Responsibilities

Assigning labor hours for all cost elements was based on expert judgment. Annual costs for wastewater sampling includes the labor to collect samples, calculate emissions, and report the results. EPA assumes that wastewater samples and emission calculations will be performed by a Plant and System Operator. These operators are already familiar with conducting wastewater testing, including BOD, suspended and dissolved solids, and dissolved oxygen, and record the results in standardized reports designed to meet Federal and State regulations.

Table 27-2. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Industrial Manager	Oversees Technician and Operator activities, including reviewing monitoring plan and emissions estimates.	$71.03/hour
Plant and System Operator	Develops monitoring plan and conducts monitoring of wastewater. Gathers plant data and estimates emissions.	$36.29/hour
Industrial Engineer/Technician	Conducts monitoring of emission sources (i.e., digester systems).	$55.20/hour

EPA estimates that two hours of labor is needed per month to collect and organize flow data, for a total annual cost of $871. EPA estimates that one hour of labor is needed for each sampling episode. Each COD wastewater sample is estimated to have analytical costs of $30, based on an average of laboratory rate schedules. EPA assumed monthly sampling episodes, which results in an annual sampling cost of $795.

Facility staff will need to calculate and report emissions once per year, using flow and COD data gathered. EPA assumes this effort will require 8 hours for an operator, with one hour of supervisory review, with a total annual cost of $361.

The annual cost to operate the continuous measurement system includes the cost to calibrate the analyzers monthly and to compile annual emission reports. These tasks are assumed to require 14 hours a year of an industrial technician. The annual costs also include $200 for gas analyzer calibration kits. The total annual costs including labor and calibration kits are $973.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are due to the annualized capital costs.

►Capital Cost Annualization and O&M Costs

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection, emissions measurement, and information storage. All costs are reported in 2006 U.S. dollars and annualization was assumed over an equipment life of 20 years with a 7% interest rate. From these factors, a capital recovery factor of .0944 was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 27-3 below summarizes the capital costs associated with the monitoring program.

Table 27-3. Monitoring Program Compliance Capital Costs and Other O&M

Element	Capital Cost	Annualized Capital Cost
Monitoring		
Equipment purchase	Continuous gas composition monitoring equipment for anaerobic digestion systems would require a continuous gas composition analyzer, a temperature sensor, a gas pressure sensor, and a data logger	$3,640

The two primary instruments used in the continuous measurement method are an in-line gas flow meter and an in-line gas composition meter. EPA assumes industrial wastewater treatment plants that are using digesters already have an in-line gas flow meter. The instruments available for continuously measuring the methane content of biogas include the Guardian Plus by Topac and the GA-2000 by Geotechnical Instruments.

The temperature and pressure of the gas flowing through the instruments must also be measured. These two parameters are generally measured with a thermocouple and a digital manometer, respectively.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs across each segment was determined by multiplying model facility costs by the number of facilities in the industry and determining total costs from the entire segment. This was done for only those facilities that exceed the reporting threshold. Then cost per facility was determined by dividing the total segment costs by the number of facilities that exceed the reporting threshold.

28. SUBPART JJ—MANURE MANAGEMENT

STEP 1: Model Facility Development

For this source category, EPA developed a number of model farms to represent the manure management systems that are most common on large farms and have the greatest potential to exceed the GHG thresholds. Operations were divided into model farms representing 12 distinct manure management systems:

- A beef farm with a pasture system;
- A beef feedlot;
- A dairy farm with an anaerobic lagoon system without solid separation;
- A dairy farm with an anaerobic lagoon system with solid separation;
- A dairy farm with a liquid/slurry system without solid separation;
- A dairy farm with a liquid/slurry system with solid separation;
- A farrow-to-finish swine farm with a deep pit system;
- A farrow-to-finish swine farm with an anaerobic lagoon system;
- A caged layer farm with an anaerobic lagoon system;
- A caged layer farm with manure drying;
- A turkey farm with bedding (litter); and
- A broiler farm with bedding (litter).

EPA determined the number of head that would need to be present at each model farm to reach the reporting threshold under consideration (assuming no anaerobic digester is present on the farm), shown in Table 28-1. Based on information from EPA's *Development Document for the Final Revisions to the National Pollutant Discharge Elimination System (NPDES) Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations (CAFOs)*, model dairy farms were assumed to have population distributions that are comprised of 63% dairy cows, 19% dairy heifers and 19% calves. At each model dairy farm, the heifers and calves were assumed to be managed on dry lots and the dairy cows were managed on liquid systems (either anaerobic lagoons or liquid/slurry systems). The population distributions for beef and swine were estimated based on the U.S. total populations from the National Inventory; this estimate assumes that all U.S. farms would have the same distribution of animal types.

Table 28-1. Threshold Populations for All Model Farms

Model Farm	1,000 $mtCO_2e$	10,000 $mtCO_2e$	25,000 $mtCO_2e$	100,000 $mtCO_2e$
BEEF FARM #1: All beef cattle types on pasture	39,129	391,290	978,224	3,912,897
BEEF FARM #2: Steers and heifers on feedlot	3,557	35,569	88,923	355,690
DAIRY FARM #1a: Cows using anaerobic lagoon, heifers and calves on dry lot with runoff pond without solid separation	201	2,012	5,029	20,115
DAIRY FARM #1b: Cows using anaerobic lagoon, heifers and calves on dry lot with runoff pond with solid separation	334	3,234	8,341	48,712
DAIRY FARM #2a: Cows using liquid/slurry, heifers and calves on dry lot with runoff pond without solid separation	447	4,468	11,171	44,684
DAIRY FARM #2b: Cows using liquid/slurry, heifers and calves on dry lot with runoff pond with solid separation	520	5,201	13,004	52,015
SWINE FARM #1: Farrow-to-Finish, Deep Pit	6,848	68,481	171,203	684,811
SWINE FARM #2: Farrow-to-Finish, Anaerobic Lagoon	2,914	29,135	72,839	291,354
POULTRY FARM #1: Layers and pullets on anaerobic lagoon WMS	39,464	358,012	895,029	3,580,116
POULTRY FARM #2: Layers and pullets on 'poultry without litter' WMS	1,465,586	13,295,708	33,239,269	132,957,076
POULTRY FARM #3: Turkeys on litter	420,458	3,814,371	9,535,927	38,143,709
POULTRY FARM #4: Broilers on litter	2,073,570	18,811,308	47,028,270	188,113,078

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs.

1. Monitoring costs

a. Start-up monitoring costs consist of both labor and capital costs. Capital investment will be required for purchasing monitoring equipment. This capital cost will be accounted as annualized cost on an annual basis. Labor will be required for product research for monitoring instruments before actual purchase. Before actual monitoring takes place, labor will have to be devoted to the development of a monitoring plan that will be used company-wide. Finally, selected employees will be trained on how to use the monitoring equipment.

b. Recurring monitoring costs consist of labor required to conduct detection and measurement of emissions (i.e., perform actual monitoring of emissions).

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Levels

Using the estimated population sizes for each model farm and threshold, EPA next determined the number of farms in the U.S. that fall into each model. EPA used the manure management system distribution from the National Inventory, in combination with data from USDA on the number of farms at different size categories, to estimate the number of farms per model that would exceed each threshold. In cases where farm size data were not available for certain thresholds, EPA used best professional judgment to estimate the number of operations that would exceed a threshold.

Some of the model farm populations required to reach threshold levels of emissions were so large that it is highly unlikely there would be any U.S. farms reaching the thresholds; other model farm populations were more plausible. Using best professional judgment based on EPA's knowledge and experience with agriculture operations, EPA assumed that the following model farms may exist with populations large enough to meet the 10,000 or 25,000 tCO_2e thresholds: dairy farms with anaerobic lagoon systems, dairy farms with liquid/slurry systems, beef feedlots, and swine farms with anaerobic lagoon systems. It was assumed that no operations would reach the 100,000 tCO_2e threshold, based on the very large number of head required to meet that threshold. Table 28-2 presents the estimated number of farms that fall within each animal type and threshold considered. For animal types with more than one model farm type, the number of farms represented by the model farms were summed to determine the total number of farms per animal type.

Table 28-2. Number of Estimated Farms for Each Threshold

Threshold Levels (tCO_2eq)		Beef	Dairy	Swine	Total
		Number of Farms			
Generated	1,000	1,071	5,118	2,036	8,225
	10,000	107	259	84	450
	25,000	11	25	8	44
	100,000	0	0	0	0
Actual emissions	1,000	1,071	5,095	2,034	8,158
	10,000	107	254	84	443
	25,000	11	25	8	42
	100,000	0	0	0	0

STEP 4: Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements

These steps are described in further detail below.

►***Determining Labor Categories***

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For the sake of this analysis, two labor categories were used as shown in Table 28-3.

Table 28-3. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate ($/hour)
Farm Owner or Designee	Oversees work at a high level. Is the final authority on all reporting requirements. Collects facility information and conducts registration and reporting. Logs data used in the monitoring process.	$49.53/hour
Farm Labor	Conducts manure sampling.	$16.12/hour

►***Allocating Responsibilities***

Assigning labor hours for all cost elements was based on expert judgment. The farm owner is responsible for collecting the data required to perform the calculations required by the rule. These data include the population of animals at the facility, the average weight of the animals, and the annual average ambient temperature. The annual gathering of these data, performing the calculations, and completing the paperwork are estimated to require 4 hours at an estimated cost of $198.

EPA estimates annual costs for manure sampling based on *The Cost Methodology for the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations* (EPA, December 2002, EPA-821-R-03-004). Labor costs for manure sampling are estimated to be $16.12 an hour for farm labor with an hour of labor needed for each sampling episode. Each sample is estimated to have

analytical costs of $40. EPA assumed monthly sampling episodes, which results in an annual sampling cost of $673.

The annual cost to operate the continuous measurement system includes the cost to calibrate the analyzers monthly and to compile annual emission reports. These tasks are assumed to require 14 hours a year at a rate of $49.53 per hour for the farm owner or designee. The annual costs also include $200 for gas analyzer calibration kits. The total annual costs including labor and calibration kits are $893.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. The only remaining facility costs are due to the annualized capital costs.

►***Capital Cost Annualization and O&M Costs***

The capital costs related to monitoring emissions and archiving of information consists of purchasing equipment for emissions detection, emissions measurement, and information storage. All costs are reported in 2006 U.S. dollars and annualization was assumed over an equipment life of 10 years with a 7% interest rate. From these factors, a capital recovery factor of 14% was calculated using the formula provided below:

$$CRF = \frac{r(1+r)^n}{(1+r)^n - 1}$$

Where CRF is the capital recovery factor, r is the interest rate, and n is the life expectancy in years. Table 28-6 below summarizes the capital costs associated with the monitoring program.

Table 28-4. Monitoring Program Compliance Capital Costs and Other O&M

Element	Capital Cost	Annualized Capital Cost
Monitoring *Equipment purchase*	Continuous gas composition monitoring equipment for anaerobic digestion systems would require a continuous gas flow meter, a continuous gas composition analyzer, a temperature sensor, a gas pressure sensor, and a data logger	$6,750
Measurement *Equipment purchase*	Manure sampler	$30

The two primary instruments used in the continuous measurement method are an in-line gas flow meter and an in-line gas composition meter. Typical flow instruments for this type of

application include the Annubar differential pressure meter by Rosemont Inc., the FT2 thermal gas flow meter by Fox Thermal Instruments, and the 5M175 turbine meter by Roots Blowers and Instruments. The instruments available for continuously measuring the methane content of biogas include the Guardian Plus by Topac and the GA-2000 by Geotechnical Instruments.

The temperature and pressure of the gas flowing through the instruments must also be measured. These two parameters are generally measured with a thermocouple and a digital manometer, respectively.

STEP 5: Estimate per Facility Costs for Each Threshold Level

The total reporting costs across each segment was determined by multiplying model farm costs by the number of farms in the industry and determining total costs from the entire segment. This was done for only those farms that exceed the reporting threshold. Then cost per farm was determined by dividing the total segment costs by the number of farms that exceed the reporting threshold.

29. SUBPART KK, LL—COAL MINES

1. Model Facility

All coal mines are required to report under this rule. A mine is defined as any facility considered by MSHA to be actively engaged in the production of coal during the reporting year. There are two model facilities, mines producing 100,000 tons or more annually during the reporting year (large mines) and those producing less than 100,000 tons annually (small mines). A section for facilities that produce liquid fuel from coal is also includes in this rule. Since no such facilities are in operation in the United States, however, a cost analysis was not conducted. It is anticipated that such facilities may be in operation in the future.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs.

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development costs consist entirely of the labor necessary to review the emissions calculation,, the emissions calculation and reporting plan, and to implement the emissions calculation and reporting plan.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs for the gathering and calculation of data. A small amount of capital costs will be needed for items such as office file cabinets and software for statistical analysis. Labor will be required to develop procedures and methodologies for reporting data to EPA.
    b. Recurring monitoring costs consist of the labor required for the gathering and calculation of data. Monitoring costs for large mines are based on the ASTM ultimate analysis of sampled coal 12 times per reporting year. It includes the gathering of data on coal rank, coal production, carbon content and GCV (Gross Calorific Value). It also includes labor necessary for the calculation of weighted

annual averages of carbon content and GCV and the derivation of CO_2 emissions. Data on coal rank, coal production and GCV are already reported and therefore, there will be no additional burden for gathering this data. The monitoring cost for small mines will involve only the gathering of representative GCV data and calculation of CO_2 emissions based on the default carbon content of coal for method 3 provided by the rule. The level of effort in the monitoring activities is higher for large mines than small mines and therefore, the monitoring cost is higher for large mines.

3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in registration.
    b. Recurring reporting costs consist of labor necessary to document the reporting of coal production, sampling and testing results, CO_2 emissions calculations, calibration records, missing data calculations, if any, and to submit the official report in each cycle (i.e., annually). The level of effort is higher for large mines than small mines because large mines must provide a large volume of supporting documentation in the compilation and computation of data to EPA.
4. Archiving and recordkeeping costs
    a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of all ASTM testing and sampling records, supporting materials for the calculation of CO_2 emissions, correlation analysis of carbon and GCV, and calibration records supplied to EPA. There should be no capital costs associated with the Rule.
    b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.
5. Auditing costs
    a. There is no start-up cost associated with auditing.
    b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility

The two model facility categories divide the mines almost in half. According to 2007 MSHA data, a total of 706 mines are producing greater than 100,000 tons annually or 52% of all mines operating during that year. Small mines (those producing less than 100,000 tons annually) make up the other 659 facilities or 48% of all U.S. mines operating in 2007.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 29-1. Model Facility Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Manager (Industrial)	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician (Refinery)	Conducts monitoring of emissions sources to collect information, perform calculations, and complete reports	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

Mines are already reporting data on coal production, domestic sales quantity by end users and quality of coal (i.e., heating content, sulfur content and ash content), but there will be some additional steps in assessing the quality and carbon content of the coal and calculation of CO_2 emissions.

Large coal mines will have to facilitate ultimate analysis using both administrative and technical resources. All coal mines will have to set up calculations, keep records, and report results. Exhibit 29-2 details the various responsibilities by labor category.

Table 29-2. Responsibilities by Labor Categories

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per facility
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for the calculations of CO_2 emissions	To set up files and filing.	Per facility
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per facility
Start-up/training	Oversee training		To acquire training	To acquire training	Per facility

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per facility
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per facility
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions	To assist in the preparation of estimate documentation	Per facility
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per facility
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per facility

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. It shows both the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

5. Estimates of Facility Costs for Each Threshold Level

Both the amount of labor and capital costs associated with reporting data to the EPA will vary between large and small coal mines. The larger mines will have to invest in a small amount of office equipment to manage the actual testing and sampling records that are required to maintain. All coal mines are likely to keep additional records that will require office equipment and supplies.

Because small mines will not have to perform ASTM Ultimate Analysis they will not require nearly as much support from all labor categories as the large mines. Estimates of facility costs for each threshold level is provided in Table 29-3.

Exhibit 29-3. Coal Mine Cost Estimate

		Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
		Manager ($71.03/hr)		Industrial Engineer/ Technician ($63.89/hr)		Administrator ($29.65/hr)		Legal Counsel ($101.00/hr)			
	Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Large Coal Mine	Registration	16.00	1.50	24.00	3.00	8.00	1.00	28.00	4.00	$5,735	$732
	Monitoring	20.00	12.00	40.00	24.00	0.00	0.00	0.00	0.00	$3,976	$2,386
	Reporting	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	$94	$94
	Archiving	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	$30	$30
	Auditing	2.00	2.00	4.00	4.00	4.00	4.00	0.00	0.00	$516	$516
	Total	38.00	15.50	69.00	32.00	14.00	7.00	28.00	4.00	$10,351	$3,757
Small Coal Mine	Registration	4.00	1.50	5.00	2.00	4.00	1.00	10.00	2.00	$1,732	$466
	Monitoring	4.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00	$476	$405
	Reporting	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	$94	$94
	Archiving	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	$30	$30
	Auditing	2.00	1.00	2.00	1.00	4.00	2.00	0.00	0.00	$388	$194
	Total	10.00	5.50	11.00	7.00	10.00	5.00	10.00	2.00	$2,720	$1,188

	Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
						First Year	Subsequent Year
Large Coal Mine	Equipment (selection, purchase, installation)[a]						
	Performance testing				$1,552	$1,552	$1,552
	Recordkeeping	$5,000	5	$1,219	$100	$1,319	$1,319
	Travel						
	Total	$5,000		$1,219	$1,652	$2,871	$2,871
Small Coal Mine	Equipment (selection, purchase, installation)[a]						
	Performance testing				$0	$0	$0
	Recordkeeping	$0		$0		$0	$0
	Travel						
	Total	$0		$0	$0	$0	$0

COAL EXPORTERS

1. Model Facility

All coal exporters are required to report under this rule with no threshold. Any U.S. coal mining company, wholesale coal dealer, retail coal dealer, or other organization that engages in the exporting of coal from the United States during the reporting year is considered to be a coal exporter.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs.

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development costs consist entirely of the labor necessary to review the emissions calculation,, the emissions calculation and reporting plan, and to implement the emissions calculation and reporting plan.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs for the gathering and calculation of data. A small amount of capital costs will be needed such as office equipment and file cabinets. The cost estimate is provided based on 12 shipments per year. Monitoring costs include cost for the gathering of data on coal rank, coal export quantity, carbon content and GCV. It also includes labor necessary for the calculation of weighted annual averages of carbon content and GCV and the calculation of CO_2 emissions, and reporting data to EPA. The data on carbon content and GCV are already required to report by the mines that producing the coal for exporting. Therefore, there will be little additional burden for gathering this data.
    b. Recurring monitoring costs consist of the labor required for reporting the data and providing annual updates to EPA.

3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in registration.
    b. Recurring reporting costs consist of labor necessary to document data on coal quantity exported, sampling and testing results, CO_2 emissions calculations, calibration records, mission data calculations and to submit the official report in each cycle (i.e., annually).
4. Archiving and recordkeeping costs
    a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of all ASTM testing and sampling records, supporting materials for the calculation of CO_2 emissions, and calibration records supplied to EPA. There should be no capital costs associated with the Rule.
    b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.
5. Auditing costs
    a. There is no start-up cost associated with auditing.
    b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

All or 100% of coal exporters engaging in the exports of coal during the reporting year are required to report. Based on publicly available data, a total of 14 companies engaged in exporting coal during that year.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 29-4. Coal Exporter Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Manager (Industrial)	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician (Refinery)	Conducts monitoring of emissions sources to collect information and complete reports.	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, and communications.	$29.65

Exhibit 2 details the various responsibilities by labor category.

Table 29-5. Responsibilities by Labor Categories

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for the calculations of CO_2 emissions	To set up files and filing	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. Coal exporters will use the data provided to them by the source mines, which would already be required to gather the same data. Exhibit 2 shows the

estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

5. Estimates of Facility Costs for Each Threshold Level

The costs per exporter as shown in Exhibit 3 would be the same regardless of the size of the exporter. All of the coal exporters will be covered.

Exhibit 3. Coal Exporter Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Manager ($71.03/hr)		Industrial Engineer/ Technician ($63.89/hr)		Adminitrator ($29.65/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	16.00	1.50	24.00	3.00	8.00	1.00	20.00	4.00	$4,927	$732
Monitoring	2.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	$653	$0
Reporting	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	$94	$94
Archiving	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	$30	$30
Auditing	2.00	2.00	4.00	4.00	4.00	4.00	0.00	0.00	$516	$516
Total	20.00	3.50	37.00	8.00	14.00	7.00	20.00	4.00	$6,220	$1,371

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]	$1,000	5	$244	$8	$252	$252
Performance testing						
Recordkeeping						
Travel						
Total	$1,000		$244	$8	$252	$252

COAL IMPORTERS

1. Model Facility

All coal importers are required to report under this rule, with no threshold. Any U.S. coal mining company, wholesale coal dealer, retail coal dealer, coal consuming electric utilities, industrial plants or other organization that imports coal into the United States during the reporting year is considered to be a coal importer.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs.

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development costs consist entirely of the labor necessary to review the emissions calculation,, the emissions calculation and reporting plan, and to implement the emissions calculation and reporting plan.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs for the gathering and calculation of data. A small amount of capital costs will be needed such as office equipment and file cabinets. The cost estimate is provided based on twelve shipments per reporting year. Monitoring costs include cost for the gathering of data on coal rank, coal import quantity, carbon content and GCV. It also includes labor necessary for developing procedures, calculating CO_2 emissions, and reporting data to EPA.
    b. Recurring monitoring costs consist of the labor required for reporting the data and providing annual updates to EPA.
3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in registration.
    b. Recurring reporting costs consist of labor necessary to document data on coal rank, coal quantity imported, sampling and testing results, CO_2 emissions

calculations, calibration records, mission data calculations and to submit the official report in each cycle (i.e., annually).

4. Archiving and recordkeeping costs
    a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies data supplied to EPA. There should be no capital costs associated with the Rule.
    b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.
5. Auditing costs
    a. There is no start-up cost associated with auditing.
    b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

All coal importers are required to report. Based on publicly available information, a total of about 20 companies imported coal into the United States during 2006.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 29-6. Coal Mine Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Manager (Industrial)	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician (Refinery)	Conducts monitoring of emissions sources to collect information and complete reports	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

Exhibit 2 details the various responsibilities by labor category.

Table 29-7. Responsibilities by Labor Categories

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for the calculations of CO_2 emissions	To set up files and filing.	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. Coal importers will use the data provided to them by the source mines. Importers can also use published carbon content values for coal of the same rank and country of origin. Exhibit 3 shows the estimate of hours and the total costs based on the above wage

rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

5. Estimates of Facility Costs for Each Threshold Level

The costs per Importer as shown in Exhibit 3 would be the same regardless of the size of the Importer. All of the Importers will be covered.

Table 29-8. Coal Importer Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Manager ($71.03/hr)		Industrial Engineer/ Technician ($63.89/hr)		Adminitrator ($29.65/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	16.00	1.50	24.00	3.00	8.00	1.00	20.00	4.00	$1,360	$0
Monitoring	2.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	$200	$0
Reporting	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	$40	$40
Archiving	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	$20	$20
Auditing	2.00	2.00	4.00	4.00	4.00	4.00	0.00	0.00	$200	$200
Total	20.00	3.50	37.00	8.00	14.00	7.00	20.00	4.00	$1,820	$260

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]	$1,000	5	$244	$8	$252	$252
Performance testing						
Recordkeeping						
Travel						
Total	$1,000		$244	$8	$252	$252

WASTE COAL RECLAIMERS

1. Model Facility

All waste coal reclaimers are required to report under this rule, with no threshold. Any U.S. facility that reclaims or recovers waste coal from waste coal piles from previous mining operations and sells or delivers to an end-user during the reporting year is considered to be a coal waste reclaimer.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs.

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development costs consist entirely of the labor necessary to review the emissions calculation,, the emissions calculation and reporting plan, and to implement the emissions calculation and reporting plan.
2. Monitoring costs
    a. Start-up monitoring costs consist only of the labor required to develop and learn a process for utilizing GCV data already available to calculate carbon content when waste coal projects is being planned and coal supply agreements are signed.
    b. Recurring monitoring costs consist of the labor required to repeat the compiling of GCV data already being collected and using the default value table provided by EPA to get an estimated carbon content and the resulting CO_2 emissions.
3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in registration.
    b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually). The report includes information on quantity of waste coal produced, coal rank, mine

location, annual CO_2 emissions, ratio of carbon content to GCV used to calculate emissions.

4. Archiving and recordkeeping costs
    a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of data supplied to EPA. There should be no capital costs associated with the Rule.
    b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.
5. Auditing costs
    a. There is no start-up cost associated with auditing.
    b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

All coal waste reclaimers are required to report. Based on publicly available information, a total of an estimated 10 companies were engaged in coal reclamation in the United States during 2007.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 29-9. Waste Coal Reclaimer Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Manager (Industrial)	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician (Refinery)	Conducts monitoring of emissions sources to collect information and complete reports	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

Exhibit 2 details the various responsibilities by labor category.

Table 29-10.Responsibilities by Labor Categories

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for the calculations of CO_2 emissions	To set up files and filing.	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. Waste coal reclaimer will use the data available from waste coal supply agreements. Exhibit 3 shows the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent

year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

5. Estimates of Facility Costs for Each Threshold Level

The costs per waste coal reclaimer as shown in Exhibit 3 would be the same regardless of the size of the company. All of the active waste coal reclaimers will be covered.

Table 29-11.Waste Coal Reclaimer Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Manager ($0.00/hr)		Industrial Engineer/ Technician ($0.00/hr)		Adminitrator ($0.00/hr)		Legal Counsel ($0.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0
Monitoring	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0
Reporting	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0
Archiving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0
Auditing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$0	$0

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]	$0		$0	$0	$0	$0
Performance testing						
Recordkeeping						
Travel						
Total	$0		$0	$0	$0	$0

30. SUBPART MM—FUEL SUPPLIERS: PETROLEUM REFINERIES

1. Model Facility

All refineries are required to report under this rule. The unit of reporting is the individual refinery. No distinction has been made between the sizes of refineries for estimating the monitoring costs because the Rule would require additional processing of data that refineries already collect and report. Under the rule, individual operating refineries are the reporters as opposed to the parent company. By way of example, Exxon Corporation owns and operates six refineries within the United States. Each operating refinery will be a reporter under this rule, not Exxon Corporation.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs. The proposed Rule anticipates that refineries will report to EPA data that they already report to EIA, thus the incremental cost of complying with this rule should be very small. The assumption underlying the costs is that refiners will calculate their emissions using the Emission Factors (EFs) contained in the default tables referred to in Subpart MM, §98.393(f) Calculation Methodology 1 (Table MM-1, Table MM-2, Table MM-3).

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development.
2. Modeling costs
    a. Start-up monitoring costs consist of both labor and capital costs. Refiners using the default EFs should not incur capital costs. Labor will be required to the develop procedures for supplying EIA Forms 810 and 820 data to EPA.

b. Recurring monitoring costs consist of the labor required for copying the EIA Forms 810 and 820 data and providing the annual updates to EPA.

3. Reporting costs

   a. There will be no start-up reporting costs; that is covered in planning.

   b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).

4. Recordkeeping costs

   a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of EIA Forms 810 and 820 data supplied to EPA and the annual emissions data. There should be no capital costs associated with the Rule.

   b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

5. Auditing costs (included in Recordkeeping costs)

   a. There is no start-up cost associated with auditing.

   b. Recurring auditing costs consists of labor required to validate results to the EPA. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

Refinery reporters are not divided into sizes or levels for purposes of reporting, 100% of the reporters are in the single category.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 30-1. Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Refinery Manager	Oversees Junior Engineer's progress and reports and interacts with Senior Executives.	$101.31
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Refinery Engineer/Technician	Conducts monitoring of emissions sources to collect information and complete reports	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

The major activities for compliance with the rules will involve taking petroleum throughput data that is already gathered by refineries for commercial reasons and for reporting to

EIA, and using the default emission factors presented in the Rule, calculating the emissions from petroleum products. Other activities will involve setting up the emissions calculation spreadsheets, recordkeeping, and reporting. Exhibit 2 identifies the major activities.

Table 30-2. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Refinery Manager	**Lawyer**	**Refinery Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per refinery
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for calculating emissions from natural gas data	To set up files and filing.	Per refinery
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per refinery
Start-up/training	Oversee training		To acquire training	To acquire training	Per refinery
Archiving and Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per refinery
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per refinery
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions from throughput data	To assist in the preparation of estimate documentation	Per refinery
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per refinery
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per refinery

b. The table below shows how EPA built up the costs for complying with the Rule. Because the data required from refineries is the same data as is required of refineries by EIA for Forms 810 and 820, most of the work would be administrative. If the default EFs are used there will be some additional steps in calculation CO_2 emissions, but after the initial setting up of spreadsheets, the data can be generated easily. Exhibit 2 shows the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

c. Using the default EFs supplied by the rule refiners should not incur any capital costs.

5. Estimates of Facility Costs for Each Threshold Level

The costs per refinery as shown in Exhibit 3 would be the same regardless of the size of the refinery. All of the refineries will be covered.

Table 30-3. Refinery Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Senior Manager ($101.31/hr)		Environmental Manager ($88.79/hr)		Environmental Engineer ($71.03/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	4.00	2.00	14.00	4.00	38.00	7.00	6.00	2.00	$4,953	$1,257
Monitoring	2.00	0.00	12.00	2.00	20.00	6.00	0.00	0.00	$2,689	$604
Reporting	1.00	0.00	4.00	1.00	8.00	1.00	0.00	0.00	$1,025	$160
Archiving	0.00	0.00	1.00	1.00	4.00	4.00	0.00	0.00	$373	$373
Auditing	0.00	1.00	0.00	4.00	0.00	4.00	0.00	1.00	$0	$842
Total	**7.00**	**3.00**	**31.00**	**12.00**	**70.00**	**22.00**	**6.00**	**3.00**	**$9,040**	**$3,235**

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]						
Performance testing						
Recordkeeping						
Travel						
Total	**$0**		**$0**	**$0**	**$0**	**$0**

FUEL SUPPLIERS: PETROLEUM IMPORTERS

1. Model Facility

All importers of petroleum products are required to report under this rule. The unit of reporting is the importing company. No distinction has been made between the sizes of companies for estimating the monitoring costs because the Rule would require additional processing of data that companies already collect and report. Under the rule, parent companies are the reporters as opposed to the individual importer/distributor. By way of example, a parent company may buy in bulk for all of its regional distributors. Each parent company will be a reporter under this rule.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs. The proposed Rule anticipates that importing companies will report to EPA data that they already report to EIA, thus the incremental cost of complying with this rule should be very small. The assumption underlying the costs is that importing companies will calculate their emissions using the Emission Factors (EFs) contained in the default tables referred to in Subpart MM, §98.393(f) Calculation Methodology 1 (Table MM-1, Table MM-2, Table MM-3).

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development.
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs. Importing companies using the default EFs should not incur capital costs. Labor will be required to the develop procedures for supplying EIA Forms 814 and 856 data to EPA.

b. Recurring monitoring costs consist of the labor required for copying the EIA Forms 814 and 856 data and providing the annual updates to EPA.

3. Reporting costs

   a. There will be no start-up reporting costs; that is covered in planning.

   b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).

4. Recordkeeping costs

   a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of EIA Forms 814 and 856 data and the annual emissions data supplied to EPA. There should be no capital costs associated with the Rule.

   b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

5. Auditing costs (included in Recordkeeping costs)

   a. There is no start-up cost associated with auditing.

   b. Recurring auditing costs consists of labor required to validate results to the EPA. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

Company importers are not divided into sizes or levels for purposes of reporting, 100% of the reporters are in the single category.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 30-4. Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Industrial Manager	Oversees Junior Engineer's progress and reports and interacts with Senior Executives.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician	Conducts monitoring of emissions sources to collect information and complete reports	$55.20
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

The major activities for compliance with the rules will involve taking petroleum product import data already gathered by the company and reported to EIA and, using the default emission

factors presented in the Rule, calculating the emissions from petroleum products. Other activities will involve setting up the emissions calculating spreadsheets, recordkeeping, and reporting. Exhibit 2 identifies the major activities.

Table 30-5. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for calculating emissions from natural gas data	To set up files and filing.	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Archiving and Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions from throughput data	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. The table below shows how EPA built up the costs for complying with the Rule. Because the data required from company importers is the same data as is required of company importers by EIA for Forms 814 and 856, most of the work would be administrative. If the default EFs are used there will be some additional steps in calculation CO_2 emissions, but after initial setting up of spreadsheets, the data can be generated easily. Exhibit 2 shows the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

c. Using the default EFs supplied by the rule company importers should not incur any capital costs

5. Estimates of Facility Costs for Each Threshold Level

The costs per company importer as shown in Exhibit 3 would be the same regardless of the size of the importer. All of the company importers will be covered.

Table 30-6. Petroleum Importer Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Senior Manager ($101.31/hr)		Environmental Manager ($88.79/hr)		Environmental Engineer ($71.03/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	4.00	2.00	14.00	4.00	32.00	7.00	6.00	2.00	$4,527	$1,257
Monitoring	2.00	0.00	8.00	2.00	12.00	4.00	0.00	0.00	$1,765	$462
Reporting	1.00	0.00	4.00	1.00	4.00	1.00	0.00	0.00	$741	$160
Archiving	0.00	0.00	1.00	1.00	4.00	4.00	0.00	0.00	$373	$373
Auditing	0.00	1.00	0.00	4.00	0.00	4.00	0.00	1.00	$0	$842
Total	**7.00**	**3.00**	**27.00**	**12.00**	**52.00**	**20.00**	**6.00**	**3.00**	**$7,406**	**$3,093**

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]						
Performance testing						
Recordkeeping						
Travel						
Total	**$0**		**$0**	**$0**	**$0**	**$0**

Subpart MM—Fuel Suppliers: Petroleum Exporters

1. Model Facility

All exporters are required to report under this rule. The unit of reporting is the individual company exporter. No distinction has been made between the sizes of exporters for estimating the monitoring costs because the Rule would require additional processing of data that exporters already collect and report.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs. The proposed Rule anticipates that exporters will report to EPA data that they already report to the Department of Commerce, thus the incremental cost of complying with this rule should be very small. The assumption underlying the costs is that exporters will calculate their emissions using the Emission Factors (EFs) contained in the default tables referred to in Subpart MM, §98.393(f) Calculation Methodology 1 (Table MM-1, Table MM-2, Table MM-3).

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development
2. Monitoring costs
    a. Start-up monitoring costs consist of both labor and capital costs. Exporters using the default EFs should not incur capital costs. Labor will be required to the develop procedures for supplying Commerce Form 7526-V data to EPA.
    b. Recurring monitoring costs consist of the labor required for copying the Commerce Form 7526-V data and providing the annual updates to EPA.
3. Reporting costs
    a. There will be no start-up reporting costs; that is covered in planning.

b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).

4. Recordkeeping costs

   a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of Commerce Form 7526-V data supplied to EPA. There should be no capital costs associated with the Rule.

   b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

5. Auditing costs (included in recordkeeping costs)

   a. There is no start-up cost associated with auditing.

   b. Recurring auditing costs consists of labor required to validate results to the EPA. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

Exporting companies are not divided into sizes or levels for purposes of reporting, 100% of the reporters are in the single category.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 30-7. Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Refinery Manager	Oversees Junior Engineer's progress and reports and interacts with Senior Executives.	$101.31
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Refinery Engineer/Technician	Conducts monitoring of emissions sources to collect information and complete reports	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

The major activities for compliance with the rules will involve taking petroleum product export data that is already reported to the Department of Commerce and, using the default emission factors presented in the Rule, calculating the emissions from petroleum exports. Other activities will involve setting up the calculating spreadsheets, recordkeeping, and reporting. Exhibit 2 identifies the major activities.

Table 30-8. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Refinery Manager	**Lawyer**	**Refinery Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for calculating emissions from natural gas data	To set up files and filing.	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Archiving and Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions from throughput data	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. The table below shows how EPA built up the costs for complying with the Rule. Because the data required from exporters is the same data as is required of exporters by Commerce for Form 7526-V, most of the work would be administrative. If the default EFs are used there will be some additional steps in calculation CO_2 emissions,

but after initial setting up of spreadsheets, the data can be generated easily. Exhibit 2 shows the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

c. Using the default EFs supplied by the rule company exporters should not incur any capital costs

5. Estimates of Facility Costs for Each Threshold Level

The costs per company exporter as shown in Exhibit 3 would be the same regardless of the size of the exporter. All of the exporters will be covered.

Table 30-9. Petroleum Exporter Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Senior Manager ($101.31/hr)		Environmental Manager ($88.79/hr)		Environmental Engineer ($71.03/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	4.00	2.00	14.00	4.00	32.00	7.00	6.00	2.00	$5,552	$1,488
Monitoring	2.00	0.00	8.00	2.00	12.00	4.00	0.00	0.00	$741	$231
Reporting	1.00	0.00	4.00	1.00	4.00	1.00	0.00	0.00	$741	$160
Archiving	0.00	0.00	1.00	1.00	4.00	4.00	0.00	0.00	$373	$373
Auditing	0.00	1.00	0.00	4.00	0.00	4.00	0.00	1.00	$0	$842
Total	**7.00**	**3.00**	**27.00**	**12.00**	**52.00**	**20.00**	**6.00**	**3.00**	**$7,406**	**$3,093**

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]						
Performance testing						
Recordkeeping						
Travel						
Total	**$0**		**$0**	**$0**	**$0**	**$0**

31. SUBPART NN—FUEL SUPPLIERS: NATURAL GAS

LOCAL DISTRIBUTION COMPANIES

1. Model Facility

All local distribution companies (LDCs) are required to report under this rule. The unit of reporting is the individual LDC. No distinction has been made between the sizes of LDCs for estimating the monitoring costs because the Rule would require additional processing of data that LDCs already collect and report. Under the rule, individual operating LDCs are the reporters as opposed to holding companies. By way of example, National Grid PLC is a holding company that operates two LDCs in New York, namely Keyspan on Long Island and Niagara Mohawk in upstate; and other LDCs in New Hampshire, Massachusetts, and Rhode Island. Each operating company in each state will be a reporter under this rule, not National Grid.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs. The proposed Rule anticipates that LDCs will report to EPA data that they already report to EIA, thus the incremental cost of complying with this rule should be very small. The assumption underlying the costs is that LDCs will calculate their emissions using the Emissions Factors (EFs) contained in the default tables referred to in Subpart NN, §98.408 Definitions (Table NN-1, Table NN-2).

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development will involve determining the procedures for complying with the regulations.
2. Monitoring costs

a. Start-up monitoring costs consist of both labor and capital costs. LDCs should not incur capital costs. Labor will be required to the develop procedures for supplying Form 176 data to EPA.

b. Recurring monitoring costs consist of the labor required for copying the EIA Form 176 data and providing the annual updates to EPA.

3. Reporting costs

   a. There will be no start-up reporting costs; that is covered in registration.

   b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).

4. Archiving and recordkeeping costs

   a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of EIA Form 176 data supplied to EPA. There should be no capital costs associated with the Rule.

   b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

5. Auditing costs

   a. There is no start-up cost associated with auditing.

   b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

LDC reporters are not divided into sizes or levels for purposes of reporting, 100% of the reporters are in the single category.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 31-1. LDC Labor Categories

Labor Category	Description	Loaded Hourly Rate ($2006)
Industrial Manager	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$71.03
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician	Conducts monitoring of emissions sources to collect information and complete reports	$55.20
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

The major activities for compliance with the rules will involve taking natural gas throughput data already gathered by the LDC and using the default emission factors presented in the Rule, calculate the emissions from natural gas. Other activities will involve setting up the calculating spreadsheets, recordkeeping, and reporting. Exhibit 2 identifies the major activities.

Table 31-2. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per company
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for calculating emissions from natural gas data	To set up files and filing.	Per company
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per company
Start-up/training	Oversee training		To acquire training	To acquire training	Per company
Archiving and Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per company
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per company
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions from throughput data	To assist in the preparation of estimate documentation	Per company
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per company
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per company

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. Because the data required from LDCs is the same data as is required of LDCs by EIA for Form 176, most of the work would be administrative. There will be some additional steps in calculation CO_2 emissions, but after initial setting up of spreadsheets, the data can be generated easily. Exhibit 3 shows the estimate of hours and the total costs based on the above wage rates and activities. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

c. Note, this Rule would not require LDCs to invest in additional capital equipment to meet the monitoring or reporting requirements. Therefore no annualized capital costs are included in this analysis.

5. Estimates of Facility Costs for Each Threshold Level

The costs per LDC as shown in Exhibit 3 would be the same regardless of the size of the LDC. All of the LDCs will be covered.

Table 31-3. LDC Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Manager ($71.03/hr)		Industrial Engineer/ Technician ($55.20/hr)		Adminitrator ($29.65/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	3.50	1.25	6.00	2.00	0.50	0.50	2.00	1.00	$797	$315
Monitoring	0.75	0.50	4.00	2.25	1.00	1.00	0.50	0.25	$354	$215
Reporting	0.25	0.25	0.50	0.50	0.50	0.50	0.10	0.10	$70	$70
Archiving	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	$14	$14
Auditing	0.00	0.20	0.00	0.80	0.00	0.20	0.00	0.10	$0	$74
Total	4.50	2.20	10.75	5.80	2.00	2.20	2.60	1.45	$1,235	$688

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]						
Performance testing						
Recordkeeping						
Travel						
Total	$0		$0	$0	$0	$0

NATURAL GAS PROCESSORS

1. Model Facility

The Rule covers all natural gas processing plants. The unit of reporting is the processing plant or facility. As defined in the Rule, these are plants designed to separate and recover natural gas liquids (NGLs) or other gases and liquids from a stream of produced natural gas and to control the quality of natural gas marketed. Thus the plants covered deliver pipeline quality natural gas to pipelines but not include field gathering and boosting stations or fractionation plants that do not deliver processed gas but only fractionate NGL streams. Companies may own more than one processing plant: each plant is required to report under this rule. No distinction has been made between the sizes of natural gas processors for estimating the monitoring costs because the Rule only would require additional processing of data that natural gas processors already collect as part of their on-going business and report on EIA Form 816.

2. Cost Elements

The total costs associated with complying with the proposed rulemaking were broken into five elements, each of which is described below. Additionally, these cost elements are considered in two ways: costs associated with start-up and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the start-up costs and are referred to as recurring costs. The proposed Rule anticipates that Processors will report to EPA data that they already report to EIA on Form 816, thus the incremental cost of complying with this rule should be small. The assumption underlying the costs is that natural gas processors will calculate their emissions using the Emissions Factors (EFs) contained in the default tables referred to in Subpart NN, §98.408 Definitions (Table NN-1, Table NN-2).

1. Regulation study and review and registration costs
    a. Start-up registration costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate registration forms.
    b. Recurring registration costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.
    c. Plan development will involve determining the procedures for complying with the regulations.
2. Monitoring costs

a. Start-up monitoring costs consist of both labor and capital costs. Processors should not incur capital costs. Labor will be required to the develop procedures for supplying Form 816 data to EPA.

b. Recurring monitoring costs consist of the labor required for copying the EIA Form 816 data and providing the annual updates to EPA.

3. Reporting costs

a. There will be no start-up reporting costs; that is covered in registration.

b. Recurring reporting costs consist of labor necessary to document collected emissions data and to submit the official report in each cycle (i.e., annually).

4. Archiving and recordkeeping costs

a. Start-up archiving and recordkeeping costs consist of labor necessary to maintain copies of EIA Form 816 data supplied to EPA. There should be no capital costs associated with the Rule.

b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

5. Auditing costs

a. There is no start-up cost associated with auditing.

b. Recurring auditing costs consists of labor required to validate to the EPA results. The EPA audit is expected to occur once in several years, not on an annual basis.

3. Proportion of Facilities in Each Model Facility Level

Processor reporters are not divided into sizes or levels for purposes of reporting, 100% of the reporters are in the single category.

4. Assigning Costs to Cost Elements

a. The typical labor categories that would be involved in meeting the requirements of the rule would include the following.

Table 31-4. Natural Gas Processor Labor Categories

Labor Category	Description	Loaded Hourly Rate (2006$)
Manager (Refinery)	Oversees Junior Engineer's progress and reports and interacts with Senior Manager.	$101.31
Lawyer	Provides legal and policy review of regulations and requirements.	$101.00
Industrial Engineer/Technician (Refinery)	Conducts monitoring of emissions sources to collect information and complete reports.	$63.89
Administrative Support	Assists in preparing documents, recordkeeping, communications.	$29.65

The major activities for compliance with the rules will involve taking NGL production data already gathered by the natural gas processor and using the default emission factors presented in the Rule to calculate the emissions from natural gas. Other activities will involve setting up the calculating spreadsheets, recordkeeping, and reporting. Exhibit 2 identifies the major activities.

Table 31-5. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer Technician**	**Administrative Support**	**Per Facility/ per Company***
Regulation Study and Review and Registration					
Regulation review	To review the new regulations	To review the new regulations and advise on responsibilities	To examine and identify potential new regulations		Per facility
Registration	To review registration documentation, company data, and emissions calculations	To review registration documentation and company data	To set up spreadsheets and systems for calculating emissions from NGL data	To set up files and filing.	Per facility
Plan development	To review the emissions calculation and reporting plan	To review the emissions calculation and reporting plan	To implement the emissions calculation and reporting plan		Per facility
Start-up/training	Oversee training		To acquire training	To acquire training	Per facility
Archiving and Recordkeeping					
Set up filing system			To set up filing system for calculations and reports	To archive the reporting documentation	Per facility
Archiving reports			To archive the reporting documentation	To archive the reporting documentation	Per facility
Monitoring					
Emissions calculations	To review the reporting documentation	To review the reporting documentation	To generate estimates of emissions from throughput data	To assist in the preparation of estimate documentation	Per facility
Auditing					
Audit	To assist in managing the audit	To monitor the audit.	To assist and provide information on EPA audits	To assist and provide information on EPA audits	Per facility
Reporting					
Report submission	Review report submission	Review report submission	Prepare and submit report	Submit report	Per facility

b. Exhibit 3 shows how EPA built up the costs for complying with the Rule. Because the data required from processors is the same data as is required by EIA for Form 816, most of the work would be administrative. There will be some additional steps in calculation CO_2 emissions, but after initial setting up of spreadsheets, the data can be generated easily. Exhibit 3 shows the estimate of hours and the total costs based on the above wage rates. We have shown costs for the first year and separately for subsequent years. Subsequent year costs include auditing costs which is an estimate of an annual average, assuming audits by EPA would be rare.

5. Estimates of Facility Costs for Each Threshold Level

The costs per Processor as shown in Exhibit 3 would be the same regardless of the size of the Processor. All of the Processors will be covered.

Exhibit 3. Natural Gas Processor Cost Estimate

	Labor Hours								Labor Cost per Year per Reporting Unit/Facility (2006$)	
	Manager ($101.00/hr)		Industrial Engineer/ Technician ($63.89/hr)		Adminitrator ($29.65/hr)		Legal Counsel ($101.00/hr)			
Activity	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year	First Year	Subseq. Year
Registration	2.17	0.58	3.67	1.17	0.50	0.25	2.00	0.67	$670	$208
Monitoring	1.00	0.50	7.00	5.75	1.00	1.00	1.00	1.00	$679	$549
Reporting	0.50	0.50	2.00	2.00	0.50	0.50	0.50	0.50	$244	$244
Archiving	0.00	0.00	0.50	0.50	0.50	0.50	0.00	0.00	$47	$47
Auditing	0.40	0.80	0.80	1.60	0.10	0.20	0.10	0.20	$105	$209
Total	4.07	2.38	13.97	11.02	2.60	2.45	3.60	2.37	$1,744	$1,256

Activity	Capital Cost (2006$)	Equipment Lifetime (years)	Annualized Capital Cost (2006$/year)	O&M Costs (2006$/year)	Total Reporting per Unit/Facility Cost (2006$)	
					First Year	Subsequent Year
Equipment (selection, purchase, installation)[a]						
Performance testing						
Recordkeeping						
Travel						
Total	$0		$0	$0	$0	$0

32. SUBPART OO—INDUSTRIAL GAS SUPPLY

Table 32-1. Number of Representative Affected Entities Used in the Cost Analysis

Threshold	Number of Representative Entities		
	Fluorinated Gas and Anesthetic Producers	Fluorinated Gas, N_2O, and CO_2 Importers (Bulk)	N_2O Producers
1,000	18	112	5
10,000	18	81	5
25,000	18	61	5
100,000	18	44	5

STEP 1: Model Facility Development

The industrial gas supply category includes facilities that produce N_2O or fluorinated GHGs (e.g., HFCs, PFCs, SF_6, NF_3, and fluorinated anesthetics), importers of N_2O or fluorinated GHGs, and exporters of N_2O or fluorinated GHGs. As described below, costs were estimated for model facilities that encompass the likely combinations of these entities and activities. In addition, because importers of fluorinated GHGs and N_2O frequently also import CO_2, and because importers would be required to sum their CO_2-equivalent imports across gases to determine whether they exceeded the reporting threshold, this analysis considers imports of CO_2. While a Technical Support Document was prepared for imports of gas in products, EPA is not proposing to require that importers of products report. Thus, imports in products are not included in the totals below. However, EPA estimates that the burden and cost per importer for importers of pre-charged products would be comparable to (slightly smaller than) those estimated below for producers and importers of bulk gases.

There are four model facilities that fall under Industrial Gas Supply. Each one represents the specific reporting activities (production, import, export, transformation, or destruction) and costs relevant to each category.

- *Fluorinated GHG (including fluorinated anesthetics) producer:* A facility that produces fluorinated GHGs. Such a facility may also transform or destroy fluorinated GHGs.
- *Fluorinated GHG Importer/Exporter:* An entity that imports or exports fluorinated GHGs. Such an entity may also transfer fluorinated GHGs to other persons for transformation or destruction.
- *N_2O Producer*: A facility that produces N_2O. Such a facility may also transform N_2O.

§ *N_2O Importer:* An entity that imports or exports N_2O. Such an entity may also transfer N_2O to other persons for transformation.

The proposed monitoring method for fluorinated GHG and N_2O producers requires measurement of the total mass of N_2O or fluorinated GHGs produced, transformed, or destroyed. Production facilities that destroy fluorinated GHGs are also required to verify the performance of destruction devices. The proposed monitoring method for fluorinated GHGs, CO_2, and N_2O importers and exporters is to report quantities imported or exported by chemical, including the quantities imported and transferred to another person for transformation or destruction.

STEP 2: Determine Cost Elements

The total costs associated with complying with the proposed rulemaking can be broken into four elements, each of which is described below.

1. Regulation compliance determination costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate compliance determination costs across all the source categories covered by the rule is discussed in section 4 of the RIA.
2. Monitoring costs. Since it is already standard procedure to meter or record the quantities of fluorinated GHGs and N_2O produced, destroyed, transformed, imported, and exported, the costs for measuring these quantities are not included in this analysis. The monitoring costs associated with complying include annual labor hours for verifying the performance of destruction devices (for those facilities that destroy gases).
3. Reporting costs. The reporting costs associated with complying include annual labor hours for pulling the annual value of the data records already measured by an instrument.
4. Recordkeeping costs. These costs were not separately estimated for this source category. The method and assumptions used to estimate recordkeeping costs across all the source categories covered by the rule is discussed in section 4 of the RIA.

STEP 3: Analyze Proportion of Facilities in the Different Model Facility Categories

To classify facilities into different groups, the activities undertaken at each model facility type were evaluated. The activities conducted by each model facility are listed under STEP 1. Table 2 indicates the number of facilities that fall into each model facility category. Because importers of fluorinated GHGs also frequently import N_2O and CO_2, Table 2 includes the number of importers of any or all of these gases, 147.

Table 32-2. Allocation of Facilities to Model Types

Segment	Number of Facilities
Fluorinated GHG Producer	
HFC, PFC, SF_6, and NF_3 Producers	12
Anesthetic Producers	6
Importer/Exporter of fluorinated GHGs, N_2O, or CO_2	
Importer/Exporters	147
N_2O Producer	
N_2O Producers	5
N_2O Importer	
N_2O Importers	18*

* Presented as background information only. Because many of the 18 N_2O importers also import fluorinated GHGs and/or CO_2, they are included in the 147 importers/exporters of fluorinated GHGs, N_2O, and CO_2.

STEP 4: Assigning Costs to Cost Elements

The assignment of costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates
2. Allocate responsibilities to labor categories to estimate labor hours
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements, if applicable.

These steps are described in further detail below.

►*Determining Labor Categories*

To evaluate labor costs, it was not only necessary to determine the amount of time required for all of the tasks associated with monitoring, but also to determine who will perform each task. For this analysis, two labor categories were used as shown in Table 3.

Table 32-3. Labor Categories and Hourly Rates

Labor Category	Description	Loaded Hourly Rate (2006$/hour)
Managerial	Oversees work at a high level and is the final authority on all reporting requirements.	$71.03/hour
Technical	Conducts monitoring of emissions sources, checks for accuracy, performs measurements.	$55.20/hour

►***Allocating Responsibilities***

Assigning labor hours for all cost elements was based on expert judgment. Table 4 summarizes the allocation of hours and responsibilities by labor category. The reporting labor hours shown in Table 4 represent the time estimated to complete the cost element for all activities applicable to that facility (i.e., production, import, export, transformation, and/or destruction). Since each facility participates in more than one activity, the cost element hours for "Report Data" (one managerial and three technical hours) were multiplied by the number of activities undertaken by that facility type, as defined in Step 1. The *destruction verification* cost element only occurs once (for fluorinated gas producers) and is therefore not multiplied by the number of facility activities.

Table 32-4. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities and Hours by Labor Category				
	Managerial		Technical		Per Facility/ per Company*
	Responsibilities	Hours	Responsibilities	Hours	
Fluorinated GHG (including fluorinated anesthetics) Producer					
Registration Compliance Data					
None estimated					
Monitoring					
Destruction verification			To verify the performance of destruction devices	2	Per facility
Reporting					
Report data	To review the data	3	To collect data records already measured by an instrument	9	Per facility
Recordkeeping					
None estimated					
Fluorinated GHG Importer/Exporter					
Registration Compliance Data					
None estimated					
Monitoring					
None estimated					
Reporting					
Report data	To review the data	4	To collect data records already measured by an instrument	12	Per facility

(continued)

Table 32-4. Responsibilities for Regulation Compliance by Labor Category (continued)

Cost Element	Responsibilities and Hours by Labor Category				
	Managerial		Technical		Per Facility/ per Company*
	Responsibilities	Hours	Responsibilities	Hours	
Recordkeeping					
None estimated					
N_2O Producer Registration Compliance Data					
None estimated					
Monitoring					
None estimated					
Reporting					
Report data	To review the data	2	To collect data records already measured by an instrument	6	Per facility
Recordkeeping					
None estimated					
N_2O Importer* Registration Compliance Data					
None estimated					
Monitoring					
None estimated					
Reporting					
Report data	To review the data	3	To collect data records already measured by an instrument	9	Per facility
Recordkeeping					
None estimated					

* Presented as background information only. If N_2O importers were to be considered separately from Fluorinated GHG Importer/Exporters, their reporting costs would be less, as shown in this table.

Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. No additional costs are assumed.

►*Capital Cost Annualization and O&M Costs*

Since it is already standard procedure to meter or record production, destruction, and transformation levels, and import/export quantities, there are no capital costs related to

monitoring emissions and archiving of information, and therefore there are no associated O&M costs.

STEP 5: Estimate per Facility Costs for Each Threshold Level

Once the labor hours were calculated, by category, for each of the cost elements (Table 4), they were multiplied by the associated labor rates (Table 3) to estimate labor costs per facility (unit cost). This unit cost was then multiplied by the number of facilities in the segment (Table 2), i.e., the number of facilities that exceed the reporting threshold, to determine the total national costs per year for this sector. Note, the number of importers/exporters of fluorinated GHGs, N_2O, or CO_2 (147) was multiplied by the per-entity costs for importers of fluorinated GHGs, which are higher than those for N_2O or CO_2 importers, to arrive at a conservative estimate of the total national costs of tracking and reporting imports and exports of fluorinated GHGs, N_2O, and CO_2. The cost estimate for 147 importers/exporters of fluorinated GHGs, N_2O, or CO_2 is inclusive of the 18 importers of N_2O identified in Table 2, and therefore, costs for N_2O importers should not be calculated separately.

33. SUBPART PP—CO_2 SUPPLY

Costs were developed for monitoring for CO_2 capture sites and CO_2 production well sites (hereafter referred to as CO_2 supply). The monitoring option is to directly measure the amount of CO_2 supply (the amount of CO_2 captured/produced by the process) using a CO_2 flow meter.

Cost estimating methodology and results for the CO_2 Supply category are summarized in this section.

1. Model Facility Development

All 13 existing CO_2 capture sites and CO_2 production well sites are included in the cost estimate. The monitoring option for each site involves a CO_2 flow meter and therefore the monitoring cost for each site is the same. Hence, model facilities were not needed for characterizing the facility and estimating the relevant costs.

2. Determine Cost Elements

For the CO_2 Supply category, total costs associated with complying with the proposed rulemaking were broken into four elements.

- Regulation compliance determination costs
- Monitoring costs
- Reporting costs
- Recordkeeping costs

These cost elements are considered in two ways: costs associated with start-up, and recurring costs. Startup costs refer to a one-time cost to get started with the reporting process. Subsequent costs for reporting on an annual basis are less than the startup costs and are referred to as recurring costs. Costs elements for the proposed option are summarized below:

- Regulation compliance determination costs
    a. Start-up costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate forms.
    b. Recurring costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.

For CO_2 Supply, no additional costs were assumed beyond the generic regulation compliance determination costs applied to all source categories.

§ Monitoring costs

Flow meters used to measure the CO_2 supply are assumed to be existing equipment for which the incremental capital cost and incremental operating and maintenance costs are zero. The total costs associated with complying with the proposed rulemaking under this monitoring option involve CO_2 flow data collection (monitoring) using the CO_2 flow meter. Monitoring costs are based on quarterly data collection of CO_2 flow meter data. All existing facilities are assumed to have CO_2 flow meters installed and operating; consequently, no startup costs are associated with this option and there are no capital costs or O&M costs associated with the monitoring option for this source category. Recurring costs initiate in the first year and are the same for each subsequent year.

Table 1 summarizes the specific monitoring equipment costs used in the analysis.

Table 33-1. Specific Monitoring Equipment Costs Used in the Analysis

Monitor Type	Initial Capital Cost (2006 $)	Annualized Cost of Capital (2006 $/yr)	Annual Operation and Maintenance Cost (2006 $/yr)
CO_2 supply flow meter[a]	$0	$0	$0

[a] The CO_2 supply flow meter is assumed to be existing equipment for which the incremental capital cost and incremental operation and maintenance cost are zero.

§ Reporting costs

a. There will be no start-up reporting costs; reporting costs are applied uniformly across source categories reporting to the rule.

b. Recurring reporting costs consist of labor necessary to document collected emissions data from CO_2 supply monitoring and to submit the official report in each cycle (i.e., annually).

§ Archiving and recordkeeping costs

a. Start-up archiving and recordkeeping costs consist of labor and annualized capital purchase of storage space. For archiving reports and associated working documents, physical storage system such as a file cabinet and electronic storage system such as an external hard drive will be required.

b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

For CO_2 Supply, no additional costs were assumed beyond the generic archiving and recordkeeping costs applied to all source categories.

§ Auditing costs

a. There is no start-up cost associated with auditing.

b. Recurring auditing costs consists of labor required to validate to the EPA results from the monitoring of CO_2 supply and the follow-up of rectifying any weaknesses found through the audit. The EPA audit is expected to occur once in several years, not on an annual basis. No additional costs were assumed for this source category beyond the generic costs for auditing applied to all source categories.

3. Analyze Proportion of Facilities in the Different Model Facility Levels

Monitoring costs are the same for each of the 13 sites; consequently, facilities were not characterized by facility type.

4. Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates;
2. Allocate responsibilities to labor categories to estimate labor hours; and
3. Determine annualized operation & maintenance (O&M) costs for each of the cost elements.

These steps are described in further detail below.

►*Determining Labor Categories*

To evaluate labor costs, necessary to determine the amount of time required for all of the tasks associated with monitoring and who will perform each task. For the purposes of this analysis, two labor categories were used as shown in Table 2.

Table 33-2. Labor Costs and Labor Hours Used in the Analysis

Labor Category	Loaded Hourly Rate (2006$)
Industrial Manager	$71.03
Industrial Engineer/Technician	$55.20

Notes:
* These rates reflect adjustments of manufacturing sector's average productivity increase of 3.7% per year for 6 quarters between 2006 Q2 and 2007 Q4, based on the estimate released by the Bureau of Labor Statistics in March 2008.
2006 Q2 labor rates were obtained from the ICF Nov, 2007 report.
Refer to ICF Nov. 2007 Report's supporting documentation for details on the wage rate calculation methodology.

Source:
Supporting Document for "Mandatory GHG Reporting Burden Assessment—Preliminary Draft," ICF, 2007. Productivity and Costs, Fourth Quarter and Annual Averages, 2007. Revised, Bureau of Labor Statistics, March 5, 2008.

►***Allocating Responsibilities***

Assigning labor hours for all cost elements was based on expert judgment. When assigning hours, the role of the labor categories were taken into consideration. Table 3 summarizes these roles.

Table 33-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer/Technician**	**Administrative Support**	**Per Facility/per Company***
Monitoring					
Plan development	To develop and review the monitoring plan	To review the monitoring plan	To develop a monitoring plan		Per facility
	0 hours[a]	*0 Hours*	*0 hours*		
Data collection	To review CO_2 flow meter data		To collect CO_2 flow meter data		Per facility
	1 hour		*3 hours*		

* For the CO_2 Supply category there is no distinction between "company" and "facility." Each of the 13 existing facilities in this category is a separate operating entity.

[a] No additional costs were assumed beyond the generic plan development costs applied to all source categories.

Labor requirements were estimated based on engineering estimates of the number of direct technical hours (i.e., industrial manager labor hours and industrial engineer/technician labor hours) needed to perform a required activity. The cost estimate is based on one industrial manager labor hour and three industrial engineer/technician labor hours per year for both the initial year and for subsequent operating years. Labor hours used in the cost analysis are summarized in Table 4.

Table 33-4. Labor Costs and Labor Hours Used in the Analysis

Industrial Source Category	Operating Period	Total Annual Labor Hours			
		Industrial Manager	**Lawyer**	**Industrial Engineer/Technician**	**Admin. Support**
CO_2 capture sites and CO_2 production well sites	First year	1	0	3	0
	Subsequent years	1	0	3	0

The CO_2 flow meter is assumed to be installed and in operation, consequently, no start-up/training labor hours are assigned for this option. Labor hours are calculated for collection of

CO_2 flow data (monitoring) using the CO_2 flow meter. Once the labor hours were calculated, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. Table 5 summarizes data collection costs used in this analysis.

Table 33-5. Data Collection Costs Used in the Analysis

Industrial Source Category	Labor Cost per Year per Reporting Unit / Facility (in 2006 dollars)		Annualized Cost of Capital (2006$/yr)		Total Reporting Unit/ Facility Cost (Labor + Annualized Capital + O&M) (2006$)	
Activity	First Year	Subsequent Years	First Year	Subsequent Years	First Year	Subsequent Years
CO_2 Supply						
Collection of CO_2 flow meter data	$166	$166			$166	$166
Manager review of CO_2 flow meter data	$71	$71			$71	$71
Total	**$237**	**$237**			**$237**	**$237**

Table 6 summarizes the total monitoring costs associated with the approach.

Table 33-6. Summary of Monitoring Cost and Uncertainty for the CO_2 Supply Category

Source Category	Monitoring Option or GHG Calculation Method	Sources of Accuracy/ Uncertainty Considered	Level of Accuracy/ Uncertainty	Annualized Unit Cost (2006$/year)	Method Complexity	Is the Method Commonly Required by Other Programs
CO_2 Supply	Direct measurement of CO_2 supply	Measurement method	High Accuracy; Uncertainty ± 2% for CO_2 flow data	$237	Low	No

►***Capital Cost Annualization and O&M Costs***

No capital costs or O&M costs are associated with this approach. The CO_2 flow meters are assumed to be already installed and in operation at the existing facilities and any O&M costs associated with these existing CO_2 flow meters are already being incurred. No incremental O&M costs for the CO_2 flow meters are assumed to be associated with the monitoring requirements.

5. Estimation of Facility Costs for Each Threshold Level

All 13 existing CO_2 suppliers would incur monitoring costs. The labor hours and monitoring costs are the same for each of the 13 existing sites; therefore the total monitoring cost is the cost for a single facility multiplied by the number of facilities (13).

6. Nationwide Cost Estimates for Proposed Option

A nationwide cost estimate was developed and is provided in Table 7.

Table 33-7. Nationwide Costs for Proposed Option

Approach	Average Annualized Cost per CO_2 Capture/Production Well Site (2006$)	Total Nationwide Annualized Cost (2006$/yr)
CO_2 Supply Flow Meter	$237	$3,076

34. PROCESS EMISSIONS FOR OTHER INDUSTRIAL SOURCE CATEGORIES

This section presents costs for proposed monitoring options for estimating process-related GHG emissions from the following sectors: ammonia, cement, ferroalloys, glass, lead, lime, phosphoric acid, silicon carbide, soda ash, titanium dioxide, and zinc. The proposed monitoring options are summarized in Table 1. The cost assumptions and cost estimates for each industrial source category for the proposed option are also described below.

Table 34-1. Summary of Proposed Monitoring Options and Cost Assumptions

Industrial Source Category	Proposed Monitoring Option
Ammonia	Continuous measurement of fuel: internally develop the methodology and monitoring plan for calculating emissions from production process; conduct managers review of samples per sampling period; contact supplier to get the carbon content of the reducing agent; and QA/QC of supplier information on carbon content of reducing agent.[a] The analysis assumes that facilities are already taking measurements of their fuel/feedstocks a part of their routine operations and for accounting purposes.
Cement[b]	If continuous emission monitoring systems (CEMS) is available, direct measurement of combustion-related and process-related CO_2 emissions from cement kilns using CEMS. If CEMS is not available facility-specific non-CEMS-based emissions estimates are to be developed using the mass-balance approach based on facility-specific analysis of carbonate and non carbonate contents of clinker produced and raw material consumption and CKD usage and disposal. The analysis is based on the understanding that cement facilities perform daily sampling and LCA of their raw materials to determine carbonate and organic carbon contents, as part of their normal business operations.
Ferroalloys	Annual carbon balance using monthly off-site sampling by facilities to determine carbon content of each carbonaceous input. The analysis assumes that facilities have measurements and records of consumption of raw materials such as reducing agents as part of their routine operations and for accounting purposes.
Glass	Monthly on-site measurements of the weight fraction of carbonate inputs (i.e., calcite, dolomite, and sodium carbonate) and calcination fractions. This method uses IPCC default emission factors. Facilities should already have information on the amount of carbonate consumed. The analysis assumes that glass production facilities are currently tracking the data required to estimate process related CO_2 emissions on routine basis (carbonate inputs, supplier information on carbonate composition of inputs).
Lead	Annual carbon balance using monthly measurement of the carbon content of up to three reductants (e.g., metallurgical coke) sent off-site for lab sampling. The analysis assumes that facilities have measurements and records of consumption of raw materials such as reducing agents as part of their routine operations and for accounting purposes.

(continued)

Table 34-1. Summary of Proposed Monitoring Options and Cost Assumptions (continued)

Industrial Source Category	Proposed Monitoring Option
Lime	Monthly on-site measurements of the weight fraction of carbonate inputs (i.e., calcite and dolomite), lime kiln dust not recycled to kiln, and calcination fractions. Application of National Lime Association method; facilities should already have information on the amount of carbonate consumed. The analysis is based on the understanding that members of the Domestic Lime Association have recommended and are using the NLA method. For example, U.S. lime manufacturing facilities report many of these measurements to the NLA, and NLA compiles annual nationwide statistics from the reported information. Consequently, the proposed approach offers an advantage in that it would use a significant amount of information that is already readily available to companies and their facilities. Given the NLA represents a significant number of lime producers and domestic lime production, the analysis assumes that lime production facilities are currently collecting the data to report process related CO_2 emissions at the facility level (monthly lime production, CaO and MgO content of lime products, calcinations of byproducts).
Phosphoric acid	Estimate CO_2 emissions based on monthly measurement of the amount of phosphate rock consumed. This method uses a regional chemical composition factor for phosphate rock. The analysis assumes facilities are already tracking and collecting the data required for estimating emissions such as such as phosphate rock feed rates and sampling and testing phosphate rock for its inorganic carbon contents. According to USGS, companies conduct analysis on the rock frequently to determine the P_2O_5 content and the level of impurities. According to CF industries (Falls 2008), they analyze a composite of incoming phosphate rock for carbon contents on a daily basis. The phosphate rock consumed or entering the digestion process is also measured on a daily basis. The analysis assumes that facilities have measurements and records of consumption of raw materials like phosphate rock as part of their routine operations and for accounting purposes.
Silicon carbide	Estimate CO_2 emissions based on quarterly measurement of the amount of petroleum coke consumed. This method uses plant specific carbon content and carbon oxidation factors. The analysis assumes that facilities have measurements and records of consumption of amount of petroleum coke as part of their routine operations and for accounting purposes.
Soda ash	Monthly measurement based on either the amount of trona consumed or the amount of soda ash output. This method utilizes the fractional purity of either the trona input or the soda ash output. The analysis assumes that facilities should already have all the necessary information available because they routinely measure purity of soda ash and/or trona inputs.
Titanium dioxide	Monthly measurement of the amount of calcined petroleum coke consumed. This method uses the IPCC default emission factor to estimate CO_2 emissions, and assumes 100% carbon content, as calcined coke is nearly 100% carbon. The analysis assumes that facilities should already have information on the amount of pet coke consumed, and should have supplier information on carbon content as part of their routine operations and for accounting purposes.
Zinc	Annual carbon balance using monthly off-site sampling of the amount of carbon contained in the reducing agent, usually metallurgical coke. The analysis assumes that facilities have measurements and records of consumption of raw materials such as reducing agents as part of their routine operations and for accounting purposes.

[a] Only costs for QA/QC of the off-site samples for ammonia have been incorporated into the cost estimates.

[b] This chapter of the cost appendix only presents cement costs using the mass-balance approach; CEMS costs are standardized and provided in Section 4 of the RIA. Of the 107 integrated cement plants in the United States, 82 plants are considered not to have any CEMS installed on their kilns. 12 plants have NO_x CEMS installed on their 21 kilns and another 13 plants have CO_2 CEMS installed on their 13 kilns.

Step 1: Model Facility Development

For the Industrial Processes sectors, insufficient data was available to differentiate costs for compiling data and conducting sampling across different facilities; hence, model facilities were not developed. Professional judgment was used to develop cost estimates and sampling frequency was assumed to not differ by facility size.

2. Cost Elements

The total costs associated with complying with the proposed rule were broken into four elements, detailed below.

1. Regulation compliance determination costs
    a. Start-up compliance determination costs consist entirely of the labor necessary to study and review the regulations to assure compliance, gather data on the facility, and fill out the appropriate forms.
    b. Recurring compliance determination costs will be small and due entirely to labor. Small amounts of time will be required for the company to stay aware of any updates to regulations and to alter the facility information to reflect any new equipment or facilities brought in operations or taken offline.

    For the industrial source categories discussed in this appendix, no additional costs were assumed beyond the generic regulation compliance determination costs applied to all source categories.
2. Monitoring costs
    a. Start-up monitoring costs consist of labor for the development of a monitoring plan that will be used company-wide, and O&M costs for the purchase of any necessary sampling equipment.
    b. Recurring monitoring costs consist of labor to conduct sampling activities, or to gather materials and send off-site for sampling on regular intervals. There are also O&M costs for off-site sampling activities

    The proposed monitoring options and associated cost assumptions are summarized in Table 1.
3. Reporting costs
    a. There will be no start-up reporting costs; reporting costs are applied uniformly across source categories reporting to the rule.
    b. Recurring reporting costs consist of labor necessary to document collected emissions data from emissions monitoring activities, to calculate emissions (if necessary), and to submit the official report in each cycle. Emissions calculation costs are presented in this appendix for cement only.
4. Archiving and recordkeeping costs

a. Start-up archiving and recordkeeping costs consist of labor and annualized capital purchase of storage space. For archiving reports and associated working documents, physical storage system such as a file cabinet and electronic storage system such as an external hard drive will be required.

b. Recurring archiving and recordkeeping costs consist entirely of labor necessary to adequately archive each cycle's report and associated working documents.

For the industrial source categories discussed in this appendix, no additional costs were assumed beyond the generic archiving and recordkeeping costs applied to all source categories.

5. Auditing costs

a. There is no start-up cost associated with auditing.

b. Recurring auditing costs consists of labor required to validate to the EPA results from the monitoring of emissions and the follow-up of rectifying any weaknesses found through the audit. The EPA audit is expected to occur once in several years, not on an annual basis.

No additional costs were assumed for this source category beyond the generic costs for auditing (or QA/QC) applied to all source categories, with the exception of Ammonia, where additional process emission QA/QC is required based on professional judgment.

3. Analyze Proportion of Facilities in the Different Model Facility Levels

For the Industrial Process sectors, this step was not necessary as model facilities were not developed.

4. Assigning Costs to Cost Elements

Assigning costs to each of the cost elements was completed in three steps:

1. Determine labor categories and associated labor rates.
2. Allocate responsibilities to labor categories to estimate labor hours.
3. Determine annualized capital costs and operation & maintenance (O&M) costs for each of the cost elements.

These steps are described in further detail below.

Determining Labor Categories

Four labor categories were used as shown in Table 2.

Table 34-2. Labor Costs and Labor Hours Used in the Analysis

Labor Category	Description	Loaded Hourly Rate (2006$)
Administrative Support	Primarily interfaces with the Industrial Engineer/Technician to collect facility information and assist with registration and reporting. Sometimes logs data used in the monitoring process.	$29.65
Industrial Engineer/Technician	Conducts monitoring of emissions sources. Interfaces between Administrative Support and Industrial Manager to collect information and complete reports.	$55.20
Industrial Manager	Oversees work at a high level; is the final authority on all reporting requirements.	$71.03
Lawyer	Provides legal review of materials.	$101.00

Notes:

* These rates reflect adjustments of manufacturing sector's average productivity increase of approximately 3.7% per year for 6 quarters between 2006 Q2 and 2007 Q4, based on the estimate released by the Bureau of Labor Statistics in March 2008.

Refer to ICF Feb 5, 2009 Memo 'describing wage rate calculation methodology.

Sources: ""

Productivity and Costs, Fourth Quarter and Annual Averages, 2007. Revised, Bureau of Labor Statistics, March 5, 2008.

Allocating Responsibilities

Assigning labor hours for all cost elements was based on expert judgment. When assigning hours, the size of the facility and role of the labor categories were taken into consideration. Table 3 summarizes these roles:

Table 34-3. Responsibilities for Regulation Compliance by Labor Category

Cost Element	Responsibilities by Labor Category				
	Industrial Manager	**Lawyer**	**Industrial Engineer/Technician**	**Administrative Support**	**Per Facility/ per Company***
Monitoring					
Plan development	To develop and review the monitoring plan	To review the monitoring plan	To develop a monitoring plan		Per facility
Material sampling	To review sampling data		Two hours per sample to conduct sampling	½ hour per sample to invoice vender	Per facility

The costs of the proposed option were estimated based on the labor requirements to collect the necessary activity data. Labor requirements are based on estimates of the number of

direct technical hours (i.e., industrial managerial labor hours, industrial engineer labor hours, administrative support and legal labor hours) needed to perform a required activity. Labor hours used in the cost analysis for each source category are summarized in Table 4.

Table 34-4. Labor Hours Used in the Analysis

Industrial Source Category	Operating Period	Total Annual Labor Hours			
		Industrial Manager	Lawyer	Industrial Engineer	Admin. Support
Ammonia	First year	16	1	37	0
	Subsequent years	10	1	24	0
Cement	First year	22	1	92	0
	Subsequent years	18	1	68	0
Ferroalloys	First year	8	1	146	30
	Subsequent years	2	1	124	30
Glass	First year	8	1	16	0
	Subsequent years	2	1	4	0
Lead	First year	8	1	94	18
	Subsequent years	2	1	76	18
Lime	First year	8	1	16	0
	Subsequent years	2	1	4	0
Phosphoric acid	First year	8	1	16	0
	Subsequent years	2	1	4	0
Silicon carbide	First year	8	1	26	2
	Subsequent years	2	1	12	2
Soda ash	First year	8	1	16	0
	Subsequent years	2	1	4	0
Titanium dioxide	First year	8	1	16	0
	Subsequent years	2	1	4	0
Zinc	First year	8	1	42	6
	Subsequent years	2	1	28	6

Estimating Sampling Costs

Table 5 summarizes the specific sampling costs used in the analysis for the various source categories. As noted earlier, the QA/QC costs for these source categories have been included as a part of estimating stationary source emissions. For Ammonia, additional costs have been estimated and included here for performing quality assurance/quality checks on supplier information for determining carbon content of feedstock. For cement calculation costs have been included as well. All costs are estimated in 2006 U.S. dollars.

Table 34-5. Annual Sampling Costs Used in the Analysis

Industrial Source Category	Labor Cost per Reporting Unit/Facility		Annualized Cost of Capital		Operation and Maintenance Costs		Total Reporting Unit/ Facility Cost (Labor + Capital + O&M)	
Activity	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years
Ammonia								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Managers review of samples per sampling period	$568	$568					$568	$568
Contact supplier to get the carbon content of the feedstock	$276	$221					$276	$221
QA/QC supplier's information on carbon content of feedstock	$883	$883			$800	$800	$1,683	$1,683
Total for Ammonia	**$3,280**	**$2,**136			**$800**	**$800**	**$4,080**	**$2,936**
Cement [a]								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Material sampling (i.e., a laboratory chemical analysis of carbon contents of raw material, clinker carbonate and non-carbonate contents, assumed six samples on average)	$2,129	$1,467			$300	$300	$2,429	$1,767
Emissions calculation costs based on facility-specific clinker analysis of carbonate and non carbonate contents, raw material consumption data, and facility-specific CKD contents of developed through chemical analysis	$3,060	$3,202			$2,200	$2,200	$5,260	$5,402
Total for Cement	**$6,742**	**$5,133**			**$2,**500	**$2,**500	**$9,241**	**$7,633**

(continued)

Table 34-5. Annual Sampling Costs Used in the Analysis (continued)

Industrial Source Category	Labor Cost per Reporting Unit/Facility		Annualized Cost of Capital		Operation and Maintenance Costs		Total Reporting Unit/ Facility Cost (Labor + Capital + O&M)	
Activity	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years
Ferroalloys								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Conduct off-site sampling to determine C content of carbonaceous inputs[a]	$8,065	$7,513			$12,000	$12,000	$20,065	$19,513
Total for Ferroalloys	**$9,617**	**$7,977**			**$12,000**	**$12,000**	**$21,617**	**$19,977**
Glass								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Total Glass	**$1,552**	**$464**					**$1,552**	**$464**
Lead								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Off-site monthly sampling of reductant (e.g., metallurgical coke)	$1,613	$1,503			$2,400	$2,400	$4,013	$3,903
Off-site monthly sampling of reductant (e.g., petroleum coke)	$1,613	$1,503			$2,400	$2,400	$4,013	$3,903
Off-site monthly sampling of reductant (e.g., carbon electrode)	$1,613	$1,503			$2,400	$2,400	$4,013	$3,903
Total for Lead	**$6,391**	**$4,972**			**$7,200**	**$7,**200	**$13,591**	**$12,172**
Lime								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Total for Lime	**$1,552**	**$464**					**$1,552**	**$464**

(continued)

Table 34-5. Annual Sampling Costs Used in the Analysis (continued)

Industrial Source Category	Labor Cost per Reporting Unit/Facility		Annualized Cost of Capital		Operation and Maintenance Costs		Total Reporting Unit/ Facility Cost (Labor + Capital + O&M)	
Activity	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years
Phosphoric Acid								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Total for Phosphoric Acid	**$1,552**	**$464**					**$1,552**	**$464**
Silicon Carbide								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Conduct off-site sampling to determine the carbon content and carbon oxidation factors of petroleum coke	$612	$501			$800	$800	$1,412	$1,301
Total for Silicon Carbide	**$2,164**	**$965**					**$2,964**	**$1,765**
Soda Ash								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Total for Soda Ash	**$1,552**	**$464**					**$1,552**	**$464**
Titanium Dioxide								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Total for Titanium Dioxide	**$1,552**	**$464**					**$1,552**	**$464**

(continued)

Table 34-5. Annual Sampling Costs Used in the Analysis (continued)

Industrial Source Category	Labor Cost per Reporting Unit/Facility		Annualized Cost of Capital		Operation and Maintenance Costs		Total Reporting Unit/ Facility Cost (Labor + Capital + O&M)	
Activity	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years	First Year	Subseq. Years
Zinc								
Internally develop the methodology and monitoring plan for calculating emissions from production process	$1,552	$464					$1,552	$464
Conduct off-site sampling to determine carbon content of inputs.	$1,613	$1,503			$2,400	$2,400	$4,013	$3,903
Total for Zinc	**$3,165**	**$1,966**			**$2,400**	**$2,400**	**$5,565**	**$4,366**

Notes: All costs are in 2006$. Totals may not sum due to independent rounding.

[a] Only includes mass balance approach; CEMS costs for cement facilities are model in Section 4 of the RIA. Cement plants, as part of their normal business operations of performing sample their raw materials for carbonate contents to confirm with the industry product quality standard for their outputs of different types of cement. Facilities are assumed to use the data collected based on their normal sampling operations to develop emissions calculations; consequently, capital costs are zero.

[b] Assumes the following carbonaceous agents: cola, coke, prebaked electrodes, electrode paste, and petroleum coke.

Estimating Capital Costs

Capital costs were not estimated for the Industrial Processes categories, since the proposed monitoring options do not require purchasing of equipment. Table 6 presents first year, subsequent year, and average annual (assuming a 10 year time period) costs for each Industrial Process category.

Table 34-6. Summary of Proposed Monitoring Options Cost and Uncertainty

Industrial Source Category	Monitoring Option or GHG Calculation Method	Sources of Accuracy/ Uncertainty Considered	Level of Accuracy/ Uncertainty	Annualized Unit Cost ($/year)	Method Complexity	Is the Method Commonly Required by Other Programs?
Ammonia	Direct measurement, contact supplier, QA/QC supplier information.			Year 1: $4,080 Subsequent years: $2,936 Average annualized cost: $3,050		No
Cement[a]	Facility-specific non-CEMS-based process-related emissions estimates are to be developed using the mass-balance approach based on facility-specific and raw material and fuel-specific carbon and carbonate contents, fuel and raw material consumption and CKD usage and disposal.			Year 1: $9,241 Subsequent years: $7,633 Average annualized cost: $7,794		
Ferroalloys	Monthly measurement of the carbon content of agents consumed, use of default factor for CH_4 emissions.			Year 1: $21,617 Subsequent years: $19,977 Average annualized cost: $20,141		
Glass	Direct measurement of inputs and application of information to facility carbonate consumption.			Year 1: $1,552 Subsequent years $464 Average annualized cost: $573		

(continued)

Table 34-6. Summary of Proposed Monitoring Options Cost and Uncertainty (continued)

Industrial Source Category	Monitoring Option or GHG Calculation Method	Sources of Accuracy/ Uncertainty Considered	Level of Accuracy/ Uncertainty	Annualized Unit Cost ($/year)	Method Complexity	Is the Method Commonly Required by Other Programs?
Lead	Monthly measurement of carbon content of reductant (off-site sampling).	Measure-ment of reductant consumed.	Uncertainty low	Year 1: $13,591 Subsequent years: $12,172 Average annualized cost: $12,314	Low	No
Lime	Direct measurement of inputs and application of information to facility carbonate consumption.			Year 1: $1,552 Subsequent years $464 Average annualized cost: $573		
Phosphoric acid	Monthly measurement of the amount of phosphate rock consumed.			Year 1: $1,552 Subsequent years $464 Average annualized cost: $573		
Silicon carbide	Quarterly measurement based on the amount of petroleum coke consumed.			Year 1: $2,964 Subsequent years: $1,765 Average annualized cost: $1,885		
Soda ash	Monthly measurement based on the amount of trona input or soda ash output.			Year 1: $1,552 Subsequent years: $464 Average annualized cost: $573		
Titanium dioxide	Monthly measurement of the amount of calcined petroleum coke consumed.	Measure-ment method	Uncertainty low	Year 1: $1,552 Subsequent years $464 Average annualized cost: $573	Low	No
Zinc	Monthly measurement of the C content of agents consumed.			Year 1: $5,565 Subsequent years $4,366 Average annualized cost: $4,486		

[a] Only includes mass balance approach; CEMS costs for cement facilities are model in Section 4 of the RIA.

Estimation of Total Facility Costs

Once the labor hours were determined, by category, for each of the cost elements, they were multiplied by the associated labor rates to estimate labor costs per facility. Annualized capital costs and O&M costs were then added to the labor cost to determine a total unit cost per facility.

5. Estimation of National Costs for Each Threshold Level

Table 7 summarizes nationwide cost estimate for the proposed option for each industrial process source category. For categories in which no threshold exists (i.e., all facilities are required to report), the national cost was determined by multiplying the facility unit cost by the estimated number of facilities in that category. For categories in which a threshold is defined (i.e., ferroalloys, glass, lead, and zinc), national costs were calculated by multiplying the facility unit cost by the estimated number of facilities that exceed the relevant threshold. These facilities were estimated as follows:

- Ferroalloys: Facility-specific emissions were approximated based on the facility's share of national production capacity. Facility-specific emissions were estimated using facility ferroalloy production capacity data provided by USGS and emission estimates provided by the Inventory of U.S. Greenhouse Gas Emissions and Sinks. The number of facilities that exceed the proposed threshold was then multiplied by the facility unit cost to calculate the total national cost.
- Glass: Facility-specific emissions were estimated from EPA's Glass Plant Database. The number of facilities that exceed the proposed threshold was then multiplied by the facility unit cost to calculate the total national cost.
- Lead: Facility-specific emissions were estimated using facility lead production capacity data provided by USGS and emission estimates provided by the Inventory of U.S. Greenhouse Gas Emissions and Sinks. For secondary lead production, each facility's emissions were approximated based on the facility's share of national production capacity. The number of facilities that exceed the proposed threshold was then multiplied by the facility unit cost to calculate the total national cost.
- Zinc: Facility-specific emissions were approximated based on the facility's share of national production capacity. Each facility's shares of national production capacity was estimated using facility zinc production capacity data provided either by USGS or contained in company 10-K Forms, and emission estimates provided by the Inventory of U.S. Greenhouse Gas Emissions and Sinks. The number of facilities that exceed the proposed threshold was then multiplied by the facility unit cost to calculate the total national cost.

Table 34-7. Nationwide Costs for Proposed Monitoring Option

Industrial Source Category	Proposed Monitoring Option	Threshold (tons CO_2e emitted)	Total Nationwide Annualized Cost	
			First Year	Subsequent Years
Ammonia	Monthly measurement of the amount of ammonia, IPCC default emission factor.	All facilities (i.e., 24 facilities)	$97,914	$70,465
Cement[a]	Facility-specific non-CEMS-based process-related emissions estimates are to be developed using the mass-balance approach based on facility-specific and raw material and fuel-specific carbon and carbonate contents, fuel and raw material consumption, and CKD usage and disposal.	All facilities (i.e., 82 facilities)	$757,762	$625,906
Ferroalloys	Monthly measurement of the C content of agents consumed.	25,000 (i.e., 8 out of 9 facilities)	$172,940	$159,816
Glass	Monthly on-site measurements of the weight fraction of carbonate inputs (i.e., calcite, dolomite, and sodium carbonate) and calcination fractions, IPCC default emission factors.	25,000 (i.e., 55 out of 375 facilities)	$85,381	$25,511
Lead	Monthly measurement of the amount of reductant consumed and off-site sampling of carbon content.	25,000 (i.e., 13 out of 27 facilities)	$176,689	$158,233
Lime	Monthly on-site measurements of the weight fraction of carbonate inputs (i.e., calcite and dolomite), lime kiln dust not recycled to kiln, and calcination fractions, IPCC default emission factors.	All facilities (i.e., 89 facilities)	$138,163	$41,282
Phosphoric acid	Monthly measurement of the amount of phosphate rock consumed, regional chemical composition factor.	All facilities (i.e., 14 facilities)	$21,733	$6,494
Silicon carbide	Quarterly measurement based on the amount of petroleum coke consumed, facility specific carbon content and carbon oxidation factors.	All facilities (i.e., 1 facility)	$2,964	$1,765
Soda ash	Monthly measurement based on the amount of trona input or soda ash output, fractional purity of trona input or soda ash output.	All facilities (i.e., 5 facilities)	$7,762	$2,319
Titanium dioxide	Monthly measurement of the amount of calcined petroleum coke consumed; IPCC default emission factor.	All facilities (i.e., 8 facilities)	$12,419	$3,711
Zinc	Monthly off-site sampling of the amount of carbon contained in the reducing agent, usually metallurgical coke.	25,000 (i.e., 4 out of 9 facilities)	$22,262	$17,466

Note: All costs are in 2006$.

[a] For cement, these costs correspond to calculating process-related CO_2 emissions based on mass-balance approach in 82 cement production facilities that do not have any type of CEMS installed on their kilns. These costs do not include combustion-related CO_2 emissions monitoring in these 82 facilities. The CEMS monitoring costs estimated to be incurred by another 25 cement plants that have either NO_x or CO_2 CEMS on their kilns are excluded from these tables; CEMS costs are estimated in Section 4 of the RIA.

February 5, 2009

MEMORANDUM

TO: Mausami Desai and Lisa Hanle, U.S. EPA

FROM: Kamala R. Jayaraman

SUBJECT: Description of the *wage rate calculation methodology* for labor categories used in the monitoring costs calculations, in support of the proposed Mandatory GHG Reporting Rulemaking

EPA Contract No. EP-W-07-068, WA No.18, Task 05.

The purpose of this memorandum is to summarize the methodology adopted to develop the loaded hourly wage rates for different labor categories used in the estimation of the average costs for monitoring GHG emissions from at the facility level. GHG emissions from production processes must be monitored, recorded, and reported by manufacturing facilities to comply with the proposed, prospective Mandatory GHG Reporting Rule (also referred to as "the rulemaking" in this memorandum). The methodology for the rulemaking was adapted from a preliminary analysis looking at incremental costs of reporting greenhouse gas emissions at the facility level. The remainder of this memorandum describes the loaded labor rates calculation methodology and reports the loaded labor rates, by components and by labor category.

Wage Rates Calculation Methodology

Loaded hourly labor rates (also referred to as "wage rates" in this memorandum) were developed for several labor categories to represent *the employer costs to use an hour of employees' time* in each of the manufacturing sector labor categories used in this analysis. The labor categories correspond to the job responsibilities of the personnel that are likely to be involved in GHG emissions monitoring activities at the manufacturing facility level to comply with the rulemaking.

(1) General Description of Loaded Hourly Labor Rate Calculation Methodology

For purposes of this study, ICF adopted the methodology used by Cody Rice (2002) to calculate the wage rates for the EPA's Toxics Release Inventory (TRI) Program. Thus, the *wage rates* calculated for different labor categories included the *employer costs for employee compensation* (comprising of the basic wages and the corresponding benefits) and *the overhead costs to the employer*.[1]

For each labor category, the following formula was used to calculate the wage rates.

*Loaded Hourly Labor Rate ($/hr.) = Basic Wages ($/hr.) * (1 + Benefits Loading Factor + Overhead Loading Factor)*

[1] For each employee, the employer also incurs *overhead costs*, comprising the rental costs of the office space, computer hardware and software, telecommunication and other equipments, organizational support, etc. required for and used by the employee to effectively fulfill his/her job responsibilities. These costs are over and above the employee compensation costs.

The *benefits loading factor* corresponds to the relative share of benefits compensation in the total employee compensation (comprising basic wages and benefits). Although the benefits factor tends to vary by labor category and by industry, for purposes of this analysis, we have assumed the benefits loading factor to remain the same for each labor category across all industries within the manufacturing sector due to a lack of availability of necessary industry-specific data on benefits paid to employees.

The *overhead loading factor* corresponds to the share of overhead costs to the employer relative to the total employee compensation. For purposes of this analysis, we have also adopted the same overhead loading factor that Cody Rice (2002) used in her wage rate calculations (described further below). Thus the overhead loading factor that we used in the wage rate calculations remains the same for all labor categories and across all industry types within the manufacturing sector.

(2) Summary of 2007-Labor Rates used in the Monitoring Costs Calculations

The wage rates (or loaded hourly labor rates) used in the calculations of monitoring costs for the rulemaking *correspond* to the 2007 fourth-quarter (2007 Q4) wage rates. These wage rates were calculated in the following two steps for all labor categories included in this analysis.

(i) First, the wage rates were calculated for May 2006 using the methodology (Rice 2002) described above. ICF developed the May 2006-wage rates for its preliminary draft report (ICF 2007), which estimated the total incremental costs of reporting facility-level GHG emissions in the U.S.

(ii) Then, the May 2006-wage rates were increased by approximately 3.7% per year for 1.5 years or six quarters (through end of 2007). The wage escalation rate used in these calculations reflected the approximate average annual growth rate in labor productivity in the manufacturing sector between 2006 and 2007. Thus the wage rates calculated for purposes of this analysis can be considered as conservative labor cost estimates as typically, wage rate growth tends to be smaller than the labor productivity growth (BLS 2008).[1]

The specific sources of data used in the May 2006 and 2007 fourth-quarter wage rate calculations are summarized in the next section. In this memorandum, these wage rates will be referred to as 2006- and 2007-wage rates, respectively.

[1] According to the Bureau of Labor Statistics (2008), the average annual growth in labor productivity in the manufacturing sector between 2006 and 2007 was 3.7%. During the same period, the average annual growth in the real hourly compensation in the manufacturing sector as a whole (2.7%) and within the durable goods producing industries (2.9%) was *smaller*. In 2006, however, the real hourly compensation rate for the manufacturing sector as a whole *decreased* by 0.5%, relative to the previous year. Between 2006 and 2007, the unit labor costs increased by 1.6% in the manufacturing sector as a whole and by 0.6% within the durable goods manufacturing sector, registering much *smaller* growth than the average productivity and real hourly compensation growth during the same period.

(3) *Detailed Description of the Data and the Methodology used in the Labor Rates Calculations*

ICF calculated the wage rates primarily using the Bureau of Labor Statistics (BLS) data on employee compensation and on labor productivity growth. These wage rates were calculated using the following methodology. Data sources used for collecting various data components used in the wage rate calculations are included in the discussion below.

- Based on the Bureau of Labor Statistics (BLS) employer costs to employee compensation data by industry sector, we identified the following eight categories to be the relevant labor categories for our analysis:
  - Electricity Sector Manager
  - Petroleum Refining Sector Manager
  - Industrial Sector Manager
  - Lawyer
  - Electricity Sector Engineer/Technician
  - Petroleum Refining Sector Engineer/Technician
  - Industrial Sector Engineer/Technician
  - Administrative Support
- For each of these labor categories, we obtained data on the basic wages and salaries (which represented unloaded hourly labor rates) from the BLS's national industry-specific *Occupational Employment Statistics* on the costs of compensation to employees for May 2006 (BLS 2006a). The basic hourly wages and salaries differed by labor categories and by the type of industry.
- To facilitate calculating benefits overloading factor for the labor categories included in this analysis, ICF collected the hourly employer compensation data comprising both the basic wages and salaries and the benefits compensation for the following three private industry *occupational groups* from BLS's *National Compensation Survey* on *Employer Costs for Employee Compensation* database for 2006 second quarter (2006 Q2) (BLS 2006b).
  - Goods Producing, Management, Professional, and Related
  - Professional and Technical Services
  - Goods Producing, Sales and Office

  These three occupational groups closely correspond to the three major labor categories (i.e., managerial, technical and administrative support, respectively) used in this analysis.

  BLS reported the average hourly total benefits as percent of the hourly total compensation for each of these three occupation groups (BLS 2006b). For 2006 second quarter, the BLS reported benefits shares in the total employee compensation, by occupational groups, as follows:
  - 33% for Managerial;
  - 27% for Technical; and
  - 30% for Administrative Support.

- ICF applied these BLS reported-total benefits shares for Managerial, Technical and Administrative Support services, as the benefits loading factors to the respective labor categories.
- ICF applied the overhead loading factor of 17% for all labor categories based on Rice (2002). The same overhead loading factor was applied to all industries, as industry-specific loading factor data were not readily available.
- 2006 wage rates were calculated as follows for all 8 labor categories included in the analysis.

  *May 2006-Loaded Hourly Labor Rate ($/hr.) = May 2006-Basic Hourly Wages & Salaries ($/hr.) * (1 + 2006 2nd Quarter-Benefits Loading Factor + 17% Overhead Loading Factor)*

- The 2006-wage rates were escalated to represent 2007 wage rates by applying the 3.67% per year growth rate for 6 quarters (or 1.5 years).

Components of Labor Costs Used in the Wage Rate Calculations

Table 1 illustrates the wage rate components for each of the 8 labor categories included in this analysis.

Table 34-8. Components of 2007-Loaded Hourly Labor Rates for Manufacturing Industry in the Private Sector, by Labor Category

Labor Category	Hourly Base Wages & Salaries[1] (2006$ Q2)	Benefits Loading Factor[2] (2006$ Q2)	Overhead Loading Factor[3]	Loaded Hourly Labor Rate[4] (2006$ Q2)	Fully Loaded Labor Rates 2007-Q4 (2006$)[5]
Manager—Electricity Sector	$ 50.46	0.4970	0.17	$ 84.12	$ 88.79
Manager—Petroleum Refining Sector	$ 57.58	0.4970	0.17	$ 95.99	$ 101.31
Manager—Industrial Sector	$ 40.37	0.4970	0.17	$ 67.30	$ 71.03
Lawyer	$ 57.40	0.4970	0.17	$ 95.69	$ 101.00
Engineer/Technician—Electricity Sector	$ 37.43	0.3699	0.17	$ 57.64	$ 60.84
Engineer/Technician—Petroleum Refining Sector	$ 39.31	0.3699	0.17	$ 60.53	$ 63.89
Engineer/Technician—Industrial Sector	$ 33.96	0.3699	0.17	$ 52.29	$ 55.20
Administrative Support	$ 17.53	0.4327	0.17	$ 28.09	$ 29.65

Notes and Sources:

[1] These base wages and salaries reflect the unloaded hourly labor rates for May 2006. These data were obtained from the BLS' *May 2006 National Industry-specific Occupational Employment and Wage Estimates, Occupational Employment Statistics* (BLS 2006a).

[2] These data reflect the relative shares of benefits in total employees' hourly compensation for 2nd quarter of 2006. These data were obtained from the BLS's the *National Compensation Survey—Compensation Cost Trends, Employer Cost for Employee Compensation* (BLS 2006b). This database was used for collecting unloaded hourly labor rates and benefits for Administrative support staff.

[3] The overhead loading factor was obtained from Rice (2002).

[4] These wage rates were developed for the ICF (2007) report, consistent with the revised methodology specified in Rice (2002).

[5] These labor rates were used for calculating the costs of monitoring GHG emissions from at the facility level in the manufacturing sector, in support of the proposed Mandatory GHG Reporting Rulemaking. These loaded hourly labor costs reflect wage rates for the end of 2007. They were calculated by escalating 2006$ Q2 loaded hourly labor rates by approximately 3.7%. This escalation also includes a small adjustment to convert the wage rates from Q2-2006$ to 2006$.

References

Bureau of Labor Statistics (BLS) 2006a. *May 2006 National Industry-specific Occupational Employment and Wage Estimates, Occupational Employment Statistics*). <http://www.bls.gov/oes/>. [NAICS 221100, 324100, 113051, 231011, 172112].

Bureau of Labor Statistics 2006b. *Employer Cost for Employee Compensation, National Compensation Survey—Compensation Cost Trends,* Customized Data Tables for 2006-Q2. <http://data.bls.gov/labjava/outside.jsp?survey=cc>.

Bureau of Labor Statistics (BLS). 2008. "Productivity and Costs, Fourth Quarter and Annual Averages, 2007 Revised," March 5. <http://www.bls.gov/news.release/archives/prod2_03052008.htm>.

ICF 2007. "Incremental Costs of Reporting Facility-level Greenhouse Gas Emissions in the United States," *Preliminary Draft Report,* Prepared for the U.S. Environmental Protection Agency, November 16.

Rice, Cody 2002. "Wage Rates for Economic Analyses of the Toxics Release Inventory Program," Analytical Support Branch, Environmental Analysis Division, Office of Environmental Information, U.S. EPA, June 10, 2002.